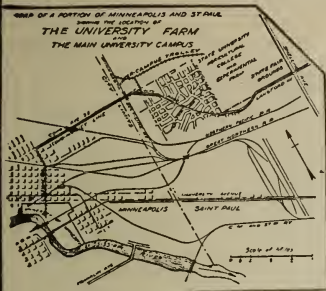
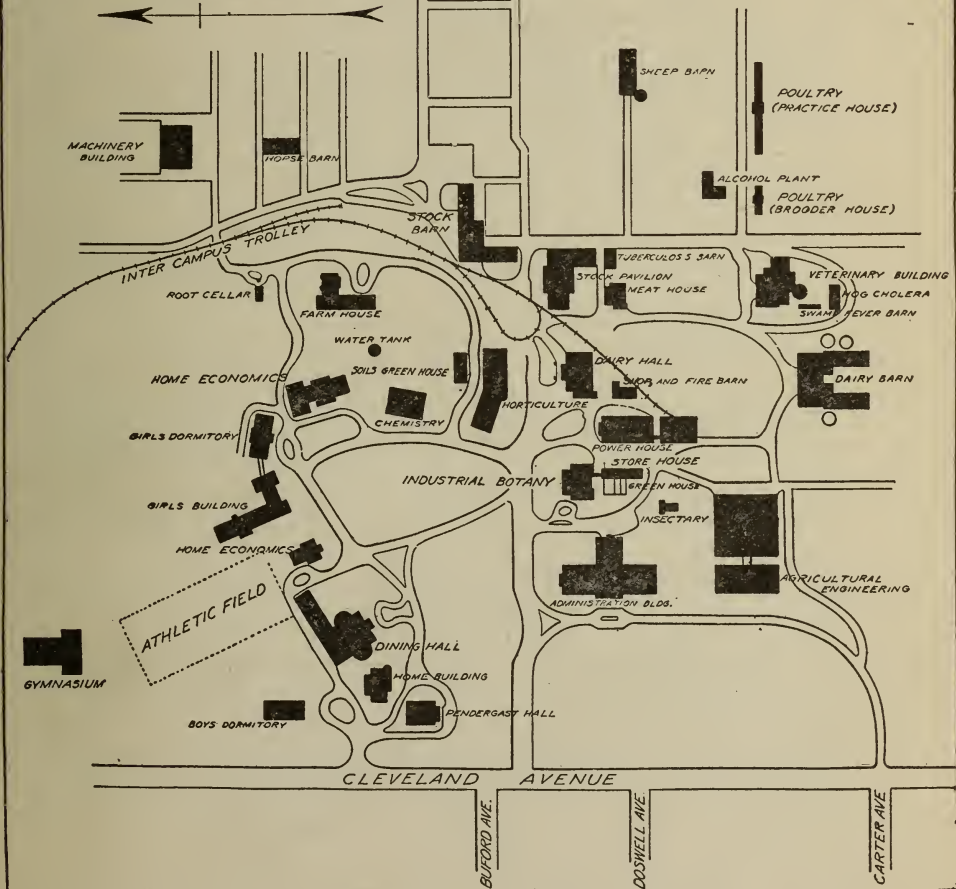


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M 660 Za  
1919-1920



# UNIVERSITY OF MINNESOTA MAP OF THE CAMPUS OF THE UNIVERSITY FARM

Scale of Feet  
100 50 0 100 200 300 400 500



O. S. Zeller.

Area of University Farm, 422.56 acres

1919							1920													
JULY							JANUARY							JULY						
Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa	Su	Mo	Tu	W	Th	Fr	Sa
..	6	7	8	9	10	11	12	..	4	5	6	7	8	9	10	11	12	13	14	15
13	14	15	16	17	18	19	20	11	12	13	14	15	16	17	18	19	20	21	22	23
20	21	22	23	24	25	26	27	18	19	20	21	22	23	24	25	26	27	28	29	30
27	28	29	30	31	..	..	25	26	27	28	29	30	31	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
AUGUST							FEBRUARY							AUGUST						
..	3	4	5	6	7	8	1	8	9	10	11	12	13	1	8	9	10	11	12	13
10	11	12	13	14	15	16	15	16	17	18	19	20	21	15	16	17	18	19	20	21
17	18	19	20	21	22	23	22	23	24	25	26	27	28	22	23	24	25	26	27	28
24	25	26	27	28	29	30	29	..	..	..	..	..	..	29	30	31	..	..	..	..
31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
SEPTEMBER							MARCH							SEPTEMBER						
..	7	8	9	10	11	12	..	14	15	16	17	18	19	..	5	6	7	8	9	10
14	15	16	17	18	19	20	21	22	23	24	25	26	27	12	13	14	15	16	17	18
21	22	23	24	25	26	27	28	29	30	31	..	..	..	19	20	21	22	23	24	25
28	29	30	..	..	..	..	28	29	30	31	..	..	..	26	27	28	29	30	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
OCTOBER							APRIL							OCTOBER						
..	5	6	7	8	9	10	..	11	12	13	14	15	16	..	10	11	12	13	14	15
12	13	14	15	16	17	18	18	19	20	21	22	23	24	17	18	19	20	21	22	23
19	20	21	22	23	24	25	25	26	27	28	29	30	..	24	25	26	27	28	29	30
26	27	28	29	30	31	..	..	..	..	..	..	..	..	31	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
NOVEMBER							MAY							NOVEMBER						
..	2	3	4	5	6	7	..	16	17	18	19	20	21	..	14	15	16	17	18	19
9	10	11	12	13	14	15	23	24	25	26	27	28	29	21	22	23	24	25	26	27
16	17	18	19	20	21	22	30	31	..	..	..	..	..	28	29	30	..	..	..	..
23	24	25	26	27	28	29	..	..	..	..	..	..	..	..	..	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
DECEMBER							JUNE							DECEMBER						
..	7	8	9	10	11	12	..	13	14	15	16	17	18	..	5	6	7	8	9	10
14	15	16	17	18	19	20	20	21	22	23	24	25	26	12	13	14	15	16	17	18
21	22	23	24	25	26	27	27	28	29	30	..	..	..	19	20	21	22	23	24	25
28	29	30	31	..	..	..	27	28	29	30	..	..	..	26	27	28	29	30	31	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

## CALENDAR

### COLLEGE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS

1919-1920

1919

September	24	Wednesday	Registration closes except for new students
September	24-30	Week	Examinations for removal of winter and spring quarter conditions and entrance examinations Registration of new students. Payment of fees
September	29	Monday	School of Agriculture, first term begins
October	1	Wednesday	Fall quarter begins
October	16	Thursday	Senate meeting, 4:00 p.m.
October	17	Friday	Half holiday. Annual freshman-sophomore contest
October	31	Friday	Last day for removal of spring quarter incompletes
November	17	Monday	Creamery Butter Makers' Short Course (ten-day session) and Cheese Makers' Short Course (four-weeks session) begin
November	27	Thursday	Thanksgiving Day; a holiday
December	1-6	Week	Ice-cream Makers' Short Course
December	8-13	Week	Milk Plant Operators' Short Course
December	18	Thursday	Senate meeting, 4:00 p.m.
December	19	Friday	Last day for winter quarter registration except for new students School of Agriculture, first term closes
December	23	Tuesday	Fall quarter closes, Christmas vacation begins 9:00 p.m.
December	24	Week	Registration of new students. Payment of winter quarter fees
January	1		
December	29	Week	Farmers' and Home Makers' Week Short Course
January	3		
January	2	Friday	Winter quarter begins
January	5	Monday	School of Agriculture, second term begins
February	2	Monday	Last day for removal of fall quarter incompletes
February	12	Thursday	Lincoln's Birthday; a holiday
February	19	Thursday	Senate meeting, 4:00 p.m.

March	17	Wednesday	Last day for spring quarter registration except for new students
March	24	Wednesday	Winter quarter closes. School of Agriculture, second term closes
March	25-30	Week	Registration of new students. Payment of spring quarter fees. Examinations for removal of fall quarter conditions
March	29	Week	Boys' and Girls' Week Short Course
April	3		
March	31	Wednesday	Spring quarter begins
April	2	Friday	Good Friday; a holiday
April	30	Friday	Last day for removal of winter quarter incompletes
May	17	Monday	Traction Engineering Short Course begins
May	20	Thursday	Senate meeting, 4:00 p.m.
June	7	Monday	Last day for summer quarter registration except for new students
June	13	Sunday	Baccalaureate service
June	14-19	Week	Threshers' Week Short Course
June	14-19	Week	Registration of new students. Payment of fees
			Examinations for removal of winter quarter conditions
June	16	Wednesday	Spring quarter closes
June	17	Thursday	Forty-eighth annual commencement
June	19	Saturday	Traction Engineering Short Course closes
June	21	Monday	*Summer quarter begins
July	19	Monday	Last day for removal of spring quarter incompletes
September	3	Friday	Summer quarter closes

\* Final arrangements for the summer quarter in 1919-20 have not been made. See later announcements.

# THE COLLEGE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS

## FACULTY

MARION LEROY BURTON, Ph.D., D.D., LL.D., President  
CYRUS NORTHROP, LL.D., President Emeritus  
ROSCOE W. THATCHER, M.A., Dean of the Department of Agriculture  
EDWARD M. FREEMAN, Ph.D., Dean of the College  
EDWARD E. NICHOLSON, M.A., Dean of Student Affairs  
....., Dean of Women  
RODNEY M. WEST, B.A., Secretary  
JOHN H. ALLISON, Ph.B., M.F., Professor of Forestry  
FREDERICK J. ALWAY, Ph.D., Professor of Soil Chemistry  
PHILIP A. ANDERSON, B.S., Assistant Professor of Animal Husbandry  
ALBERT C. ARNY, B.S., in Agr., Associate Professor of Farm Crops  
CLYDE H. BAILEY, M.S., Associate Professor of Agricultural Biochemistry  
LOUIS B. BASSETT, Assistant Professor of Farm Management  
JERE BAXTER, Major, U.S.A., Assistant Professor of Military Science and  
Tactics  
HENRY C. BERTELSEN, First Lieutenant, U.S.A., Assistant Professor of  
Military Science and Tactics  
ALICE BIESTER, M.A., Assistant Professor of Nutrition  
ALMA L. BINZEL, B.S., Assistant Professor of Child Training  
GUY R. BISBY, B.S., Assistant Professor of Plant Pathology  
JOHN D. BLACK, M.A., Assistant Professor of Economics  
ANDREW BOSS, Professor of Agronomy and Farm Management  
WILLIAM BOSS, Professor of Farm Engineering  
WILLARD L. BOYD, D.V.S., Professor of Veterinary Medicine and Surgery  
WILFRID G. BRIERLEY, M.S., Associate Professor of Horticulture  
CLARA M. BROWN, B.A. in Educ., Assistant Professor of Home Economics  
FRANK H. BURTON, Colonel, U.S.A., Professor of Military Science and  
Tactics  
LEROY CADY, B.S., in Agr., Associate Professor of Horticulture  
ROYAL N. CHAPMAN, M.A., Assistant Professor of Animal Biology  
EDWARD G. CHEYNEY, B.A., Professor of Forestry  
ARTHUR E. CLARK, Captain, U.S.A., Assistant Professor of Military  
Science and Tactics  
LOUIS J. COOKE, M.D., Director of Physical Education for Men  
JOSEPH C. CORT, M.S., Assistant Professor of Dairy Husbandry  
WILLIAM W. CUMBERLAND, Ph.D., Associate Professor of Economics  
MAXWELL J. DORSEY, Ph.D., Associate Professor of Horticulture  
R. ADAMS DUTCHER, M.S., M.A., Assistant Professor of Agricultural Bio-  
chemistry  
WILLIAM P. DYER, B.A., Assistant Professor of Agricultural Education



- CLARENCE H. ECKLES, M.S., D.Sc., Professor of Dairy Husbandry  
 ALBERT M. FIELD, M.S., Assistant Professor of Agricultural Education  
 CLIFFORD P. FITCH, M.S., D.V.M., Professor of Animal Pathology and Bacteriology  
 EDWARD M. FREEMAN, Ph.D., Professor of Botany and Plant Pathology  
 RALPH J. GARBER, M.S., Assistant Professor of Agronomy  
 CARL W. GAY, D.V.M., B.S.A., Professor of Animal Husbandry  
 HARRIET I. GOLDSTEIN, Assistant Professor of Drawing and Design  
 ROSS AIKEN GORTNER, Ph.D., Professor of Agricultural Biochemistry  
 THEOPHILUS L. HAECKER, Professor Emeritus of Dairy Husbandry  
 EDWIN O. HANSON, Assistant Professor of Dairy Husbandry  
 HERBERT K. HAYES, M.S., Associate Professor of Plant Breeding  
 FRANCIS JAGER, Professor of Bee Culture  
 WILLIAM H. KENETY, M.S., Assistant Professor of Forestry  
 HOWARD C. H. KERNKAMP, D.V.M., Assistant Professor of Veterinary Medicine  
 WILLIAM P. KIRKWOOD, B.A., Professor of Journalism  
 MAY S. KISSOCK, B.A., Assistant Professor of Physical Education for Women  
 ROBERT C. LANSING, M.A., Assistant Professor of Rhetoric  
 DEXTER D. MAYNE, Professor of Agricultural Pedagogics  
 MAUDE MILLER, B.S., Assistant Professor of Home Economics  
 WILLIAM MOORE, B.A., Associate Professor of Research in Economic Zoology  
 CLARENCE A. MORROW, Ph.D., Assistant Professor of Agricultural Biochemistry  
 AMY P. MORSE, B.A., Assistant Professor of Drawing and Design  
 ALLEN T. NEWMAN, Captain, U.S.A., Assistant Professor of Military Science and Tactics  
 J. ANNA NORRIS, M.D., Professor of Physical Education for Women  
 ERNEST O. NUOFFER, Second Lieutenant, U.S.A., Assistant Professor of Military Science and Tactics  
 OSCAR W. OESTLUND, Ph.D., Assistant Professor of Animal Biology  
 LEROY S. PALMER, Ph.D., Associate Professor of Agricultural Biochemistry  
 E. MAUDE PATCHIN, B.S., Assistant Professor of Textiles and Clothing  
 FRANCIS W. PECK,<sup>1</sup> M.S., Associate Professor of Farm Management  
 WALTER H. PETERS, B.S.A., Professor of Animal Husbandry  
 NORMAN J. RADDER, B.A., Assistant Professor of Journalism  
 MYRON H. REYNOLDS, B.S.A., D.V.M., M.D., Professor of Veterinary Medicine and Surgery  
 WILLIAM A. RILEY, Ph.D., Professor of Entomology  
 HARRY B. ROE, B.S. in Eng., Assistant Professor of Farm Engineering  
 CLAYTON O. ROST, M.A., Assistant Professor of Soils  
 ARTHUR G. RUGGLES, M.A., Associate Professor of Entomology

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<sup>1</sup> On leave of absence, 1919-20,

ARTHUR C. SMITH, B.S., Professor of Poultry Husbandry  
ELVIN C. STAKMAN, Ph.D., Professor of Plant Pathology  
FREDERICK H. STEINMETZ, B.S. in Agr., Assistant Professor of Agronomy  
JOHN T. STEWART, C.E., Professor of Agricultural Engineering  
ASHLEY V. STORM, M.A., Professor of Agricultural Education  
NOLA TREAT, B.S., Assistant Professor of Institutional Management  
ARTHUR G. TYLER, Assistant Professor of Farm Engineering  
HENRY W. VAUGHN, M.S. in Agr., Professor of Animal Husbandry  
ELIZABETH VERMILYE, B.A., Assistant Professor of Foods and Cookery  
FREDERIC L. WASHBURN, M.A., Professor of Entomology  
ROBERT M. WASHBURN, M.S.A., Professor of Dairy Husbandry  
MILDRED WEIGLEY, B.S., Professor of Home Economics  
MARION WELLER, B.A., Assistant Professor of Textiles  
JOHN P. WENTLING, M.A., Associate Professor of Forestry  
HALL B. WHITE, B.S. in Agr., Assistant Professor of Farm Buildings  
JOHN J. WILLAMAN, M.S., Assistant Professor of Agricultural Analysis  
ARTHUR L. ANDERSON, B.S., Instructor in Animal Husbandry  
JOHN V. ANKENY, B.S., Instructor in Agricultural Education  
GERTRUDE M. BAKER, Instructor in Physical Education for Women  
HELEN A. BARR, B.A., Instructor in Physical Education for Women  
WILLIAM A. BILLINGS, D.V.M., Instructor in Pathology  
JOHN J. BOWENS, Sergeant, U.S.A., Instructor in Military Science and Tactics  
CARLOTTA BROWN, Instructor in Millinery  
EDWIN S. BROWN, B.S., M.D., Instructor in Physical Education for Men  
NORRIS K. CARNES, B.S., Instructor in Animal Husbandry  
ESTELLE COOK, Instructor in Rhetoric  
WILLIAM T. COX, B.S., in For., Special Lecturer in Forestry  
FRANK CRAIN, Sergeant, U.S.A., Instructor in Military Science and Tactics  
ROBERT C. DAHLBERG, B.S., in Agr., Instructor in Agricultural Botany  
J. GRANT DENT, Instructor in Farm Engineering  
JEAN MUIR DORSEY, B.S. in H.E., Instructor in Foods Management  
HALLY J. FISHER, R.N., Instructor in Home Nursing  
ELDEN R. FOSSEY, Sergeant, U.S.A., Instructor in Military Science and Tactics  
WILLIAM K. FOSTER, LL.M., Assistant Director of Gymnasium  
LLOYD V. FRANCE, M.S. in Agr., Instructor in Bee Culture  
GEORGE G. GLICK, B.A., Instructor in Rhetoric  
PERCY C. GLIDDEN, Instructor in Physical Education for Men  
VETTA GOLDSTEIN, Instructor in Textiles and Clothing  
RASMUS M. HALL, Instructor in Agricultural Physics  
JOSEPH HAVLICEK, Sergeant, U.S.A., Instructor in Military Science and Tactics  
MAURICE G. JACOBSON, Instructor in Farm Engineering  
ALLEN D. JOHNSTON, Instructor in Blacksmithing  
HERBERT KETTLE, Sergeant, U.S.A., Instructor in Military Science and Tactics

VALERIA G. LADD, B.A., Instructor in Physical Education for Women  
 ALVIN H. LARSON, B.S. in Agr., Instructor in Agricultural Botany  
 RUTH M. LINDQUIST, B.S., Instructor in Foods Management  
 MABEL C. McDOWELL, B.S., Instructor in Foods Management  
 PAUL R. McMILLER, M.S., Instructor in Soils  
 OLIVE B. McCOMBER, Instructor in Textiles and Clothing  
 D. C. MITCHELL, B.S. in C.E., Instructor in Physical Education for Men  
 RUTH MOHL, M.A., Instructor in Rhetoric  
 MARTHA B. MOORHEAD, M.D., Lecturer in Hygiene  
 MARGARET K. MUMFORD, B.A., Instructor in Foods and Cookery  
 ALLEN G. NEWHALL, B.S., Instructor in Plant Pathology  
 WILLIAM G. PALMS, Sergeant, U.S.A., Instructor in Military Science and Tactics  
 ABE PEPINSKY, Instructor in Violin and Director of Orchestra  
 ETHEL L. PHELPS, B.S., Instructor in Textiles and Clothing  
 LENORE RICHARDS, B.A., Instructor in Institutional Management  
 GERTRUDE B. SCHILL, B.A., Instructor in Physical Education for Women  
 LAVINIA STINSON, B.A., Instructor in Foods and Cookery  
 DILLON P. TIERNEY, M.F., Special Lecturer in Forestry  
 ALICE H. TOLG, M.D., Instructor in Physical Education for Women  
 JAMES B. TORRANCE, Instructor in Farm Engineering  
 LESLIE V. WILSON, B.S. in D.H., Instructor in Dairy Husbandry  
 KARL P. BUSWELL, Assistant in Physical Education for Men  
 HARRY GOLDIE, Assistant in Physical Education for Men  
 SAMUEL A. GRAHAM, B.S. in For., Assistant in Entomology and Economic Zoology  
 CLAUDE D. GRINNELLS, D.V.M., Assistant in Veterinary Medicine  
 ANNA WENTZ, Assistant in Entomology and Economic Zoology

#### EXTENSION STAFF

ARCHIE D. WILSON, B.S. in Agr., Director  
 CLARENCE H. WELCH, Secretary, Agricultural Extension Division  
 MARGARET B. BAKER, Assistant State Leader, Boys' and Girls' Club Work  
 FRANK E. BALMER, B.S. in Agr., State Leader County Agricultural Agents  
 MARY L. BULL, Home Economics Specialist  
 WILLIAM L. CAVERT, M.S., Farm Management Specialist  
 NORTON E. CHAPMAN, M.A., Poultry Husbandry Specialist  
 SPENCER B. CLELAND, B.S., Assistant State Leader County Agents  
 LUCY CORDINER, Home Economics Specialist  
 JOSEPHINE CREELMAN, Home Nursing Specialist  
 JAMES M. DREW, Assistant  
 THEODORE A. ERICKSON, B.A., State Leader Boys' and Girls' Club Work  
 LEWIS H. FUDGE, Assistant State Leader Boys' and Girls' Club Work  
 ROY H. GIBERSON, Assistant State Leader Boys' and Girls' Club Work  
 ALBERTHA GUSTAFSON, B.S., Assistant State Leader Boys' and Girls' Club Work



EDWIN HASLERUD, Assistant in charge of Cow Testing Associations  
GEORGE F. HOWARD, Assistant State Leader Boys' and Girls' Club Work  
J. SENECA JONES, Assistant State Leader County Agents  
KEMPER A. KIRKPATRICK, Assistant State Leader County Agents  
ARTHUR J. KITTELSON, Assistant State Leader Boys' and Girls' Club  
THOMAS B. MCCULLOUGH, Demonstration Farm Specialist  
ARTHUR J. MCGUIRE, B.Agr., Reclamation and Livestock Specialist  
WILLIAM A. MCKERROW, Livestock Specialist  
ROGER S. MACKINTOSH, B.S. in Agr., Horticultural Specialist  
WILLIAM E. MORRIS, Assistant State Leader County Agents  
GEORGE H. NESOM, B.S., Soil Specialist  
JULIA O. NEWTON, B.A., Assistant State Leader in Home Economics  
RETT E. OLMSTEAD, Farmers' Club Specialist  
ALLAN B. RAYBURN, B.S., Dairy Specialist  
MAY SECREST, State Leader in Home Economics  
JUNIATA L. SHEPPERD, M.A., Home Economics Specialist  
ARNE G. TOLAAS, M.S., Plant Pathology Specialist

MEMBERS OF OTHER FACULTIES GIVING INSTRUCTION IN  
THE COLLEGE OF AGRICULTURE, FORESTRY, AND  
HOME ECONOMICS

CEPHAS D. ALLIN, M.A., LL.B., Professor of Political Science  
FRANCIS B. BARTON, Docteur de l'Université de Paris, Assistant Professor  
of Romance Languages  
LUTHER L. BERNARD, Ph.D., Associate Professor of Sociology  
ROY G. BLAKEY, Ph.D., Associate Professor of Economics  
OSCAR C. BURKHARD, Ph.D., Assistant Professor of German  
FREDERIC K. BUTTERS, Ph.D., Assistant Professor of Botany  
LOTUS D. COFFMAN, Ph.D., Professor of Education  
WILLIAM S. COOPER, Ph.D., Assistant Professor of Botany  
JAMES DAVIES, Ph.D., Assistant Professor of German  
HERMIONE L. DEALEY, Ph.D., Assistant Professor of Educational Psychology  
Z. CLARKE DICKINSON, B.A., Assistant Professor of Economics  
HAL DOWNEY, Ph.D., Associate Professor of Animal Biology  
GEORGE W. DOWRIE, Ph.D., Professor of Economics  
ELIAS J. DURAND, B.S.C., Professor of Botany  
J. FRANKLIN EBERSOLE, Ph.B., Professorial Lecturer in Economics  
RICHARD M. ELLIOTT, Ph.D., Associate Professor of Psychology  
MANUEL C. ELMER, Ph.D., Associate Professor of Sociology  
WILLIAM H. EMMONS, Ph.D., Professor of Geology  
HENRY A. ERICKSON, Ph.D., Professor of Physics  
DONALD N. FERGUSON, B.A., Assistant Professor of Pianoforte  
MABEL R. FERNALD, Ph.D., Assistant Professor of Psychology  
ROSS L. FINNEY, Ph.D., Assistant Professor of Sociology

WILLIAM S. FOSTER, Ph.D., Associate Professor of Psychology  
JULES T. FRELIN, B.A., Assistant Professor of French  
ISAAC W. GEIGER, Ph.D., Assistant Professor of Chemistry  
N. S. BRIEN GRAS, Ph.D., Professor of Economic History  
FRANK F. GROUT, M.S., Professor of Geology and Mineralogy  
ALVIN H. HANSEN, B.A., Associate Professor of Economics  
PEDRO HENRIQUEZ URENA, Bachiller en Ciencias y Letras, Abogado, Professorial Lecturer in Romance Languages  
CLARENCE L. HOLMES, M.A., Assistant Professor of Economics  
WILLARD E. HOTCHKISS, Ph.D., Professor of Economics  
RALPH E. HOUSE, Ph.D., Associate Professor of Romance Languages  
NED L. HUFF, M.A., Assistant Professor of Botany  
WILLIAM H. HUNTER, Ph.D., Associate Professor of Chemistry  
ALBERT E. JENKS, Ph.D., Professor of Anthropology  
A. WOLFRED JOHNSTON, M.A., Assistant Professor of Geology  
LAUDER W. JONES, Ph.D., Professor of Chemistry  
LEE I. KNIGHT, Ph.D., Professor of Botany  
ALFRED E. KOENIG, M.A., Dr. Theol., Assistant Professor of German  
SAMUEL KROESCH, Ph.D., Assistant Professor of German  
WINFORD P. LARSON, M.D., Professor of Bacteriology  
KARL S. LASHLEY, Ph.D., Assistant Professor of Psychology  
ELMER J. LUND, Ph.D., Assistant Professor of Zoology  
GUSTAF A. LUNDQUIST, M.A., Assistant Professor of Sociology  
FRANK H. MACDOUGALL, Ph.D., Associate Professor of Chemistry  
LOUALLEN F. MILLER, M.A., Professorial Lecturer in Physics  
RAYMOND MOLEY, Ph.D., Associate Professor of Political Science  
JOHN J. B. MORGAN, Ph.D., Assistant Professor of Psychology  
BRUCE D. MUDGETT, B.A., Associate Professor of Economics  
WALTER R. MYERS, Ph.D., Assistant Professor of German  
HENRY F. NACHTRIEB, B.S., Professor of Animal Biology  
EVERETT WARD OLMSTED, Ph.D., Professor of Romance Languages  
RUTH S. PHELPS, M.A., Assistant Professor of Romance Languages  
CHESSLEY J. POSEY, M.S., Assistant Professor of Geography  
TERENCE T. QUIRKE, Ph.D., Assistant Professor of Geology  
THOMAS S. ROBERTS, M.D., Professor of Ornithology  
CARL OTTO ROSENDAHL, Ph.D., Professor of Botany  
THOMAS H. SANDERS, M. of Commerce, Assistant Professor of Economics  
CARL SCHLENKER, B.A., Professor of German  
CARLYLE M. SCOTT, Professor of Music  
JOHN H. SHERMAN, B.A., Professorial Lecturer in Economics  
CHARLES F. SIDENER, B.S., Professor of Chemistry  
CHARLES P. SIGERFOOS, Ph.D., Professor of Zoology  
EDWARD H. SIRICH, Ph.D., Assistant Professor of Romance Languages  
FLETCHER H. SWIFT, Ph.D., Professor of Education  
JOHN T. TATE, Ph.D., Associate Professor of Physics  
JOSEPHINE E. TILDEN, M.S., Professor of Botany  
ARTHUR J. TODD, Ph.D., Professor of Sociology

MARVIN J. VAN WAGENEN, Ph.D., Assistant Professor of Education  
 FRANK C. WHITMORE, Ph.D., Assistant Professor of Chemistry  
 HERBERT WOODROW, Ph.D., Associate Professor of Psychology  
 JEREMIAH S. YOUNG, Ph.D., Professor of Political Science  
 ANTHONY ZELNY, Ph.D., Professor of Physics  
 JEAN H. ALEXANDER, M.A., Instructor in Education  
 GEORGE D. ALLEN, M.S., Instructor in Animal Biology  
 ANNE G. BENTON, B.A., Instructor in Bacteriology  
 THOMAS M. BRODERICK, Ph.D., Instructor in Geology  
 HERBERT E. CLEFTON, M.A., Instructor in Romance Languages  
 SOLOMON M. DELSON, Ph.B., Instructor in Romance Languages  
 MARGUERITE GUINOTTE, Brevet Supérieur l'Académie, Instructor in Romance Languages  
 ALBERT J. LOBB, Ph.B., LL.B., Instructor in Political Science  
 FRANCES E. LOWELL, B.A., Instructor in Psychology  
 FRANCES M. MOREHOUSE, M.A., Instructor in History, University High School  
 VICTOR H. PELZ, M.A., Instructor in Economics  
 GERTRUDE REEVES, Instructor in Pianoforte  
 ADOLPH R. RINGOEN, M.A., Instructor in Animal Biology  
 J. WARREN STEHMAN, M.A., Instructor in Economics  
 SAMUEL VASCONCELOS, B.A., LL.B., Abogado, Instructor in Romance Languages  
 GUY H. WOOLLETT, Ph.D., Instructor in Chemistry  
 ROBERT G. GREEN, B.A., Assistant in Bacteriology  
 SIEGFRIED F. HERRMANN, B.S., M.B., Assistant in Bacteriology

## FACULTY COMMITTEES

1919-1920

*Executive.*—The Executive Committee of the Department of Agriculture  
*Enrollment.*—WEST, BIESTER, MORROW, PIERCE, WENTLING

*Curriculum.*—FREEMAN, BOSS, BIESTER, CHEYNEY, GAY, WENTLING, RILEY,  
 STORM, WEIGLEY, WELLER, WENTLING, WEST

*Students' Work.*—FREEMAN, CHEYNEY, NICHOLSON, WEIGLEY, WEST

*Student Organizations.*—LANSING, FITCH, FREEMAN, MILLER, WELLER

*Appointment.*—STORM, WEIGLEY

*Farm Experience.*—BOSS, BRIERLEY

*Faculty Business.*—GORTNER, RUGGLES, STAKMAN, VERMILYE

## GENERAL INFORMATION

### ADMISSION

New students are admitted at the opening of any quarter.

All students entering for the first time must submit their credentials to the Enrollment Committee

Admission is either by certificate or by examination. Candidates must have completed the equivalent of a four-year high-school course and must present:

1. Four units of English; or three units of English and four units of a foreign language; or three units of English and two units in each of two foreign languages.
2. One unit of elementary algebra and one unit of plane geometry.
3. Enough additional work to make in all fifteen units, of which not more than four may be in subjects not listed in the admission groups in the General Information Bulletin.

Graduates of the School of Agriculture of the University of Minnesota who have completed the two summers of supervised work offered in the School course, one additional School year, and one additional summer's work, or the equivalent thereof, will be admitted to the College of Agriculture, Forestry, and Home Economics.

For details of admission requirements and definition of "unit," see the Bulletin of General Information.

Every prospective student is urged to obtain before entering college at least six months' practical experience on a farm. Entering students whose farm experience credentials are not satisfactory will be examined as to their familiarity with farm practices, and farm experience will be required during the college course in accordance with the results of these examinations. For students specializing in Dairy Husbandry at least three of the six months of approved farm experience must be on an accredited dairy farm.

Applicants for admission are urged to present physics (1 unit), chemistry (1 unit), and higher algebra ( $\frac{1}{2}$  unit), for entrance credits. If these subjects are not completed in the high school, they will have to be taken in the University, thus postponing some of the vocational courses.

### FEES

*Free tuition.*—The State will pay the tuition of any student who served in the army, navy, or marine corps of the United States during any war in which the United States has been involved, including members of the National Guard or who, upon the call of the president, performed military service outside the borders of Minnesota in any trouble with Mexico; and of any student who performed overseas service as a regularly enlisted full-time worker of the Red Cross, engaged in nursing the sick or assisting in the care of soldiers in any government hospital, field or camp, which service has been officially recognized by the National Government. The amount of this free tuition is not to exceed \$200 for any

one person and the benefits of this act will not extend beyond July 1, 1924. The amount to be paid in any year will be limited by the legislative appropriation for that year.

Application for this free tuition should be made to the Secretary's Office at the time of registration. This applies only to students, who at the time of enlistment were citizens and residents of the State of Minnesota.

Tuition includes all of the regular quarter charges listed below except the deposit and penalty fees for change of registration, late registration, condition examinations, etc.

Tuition fee (per quarter)	
Residents of Minnesota.....	\$14.00
Non-residents .....	28.00
Deposit (first quarter only).....	5.00
Health fee (per quarter).....	2.00
Minnesota Union (per quarter).....	.70
Special fees	
Examination for removal of conditions.....	1.00
Examinations for credit (after the first quarter in residence).....	5.00
Special examinations .....	5.00
Change of registration.....	2.50

*Late registration.*—Old students must indicate their registration not later than two weeks before the day set for classes to begin. All students must complete their registration (including payment of fees) before the day set for classes to begin. Penalty for delay in either indicating or completing registration, five dollars. An additional dollar is charged for each day of delay after the last day set for the completion of registration and a similar charge is made for each day of delay after the last day set for payment of fees.

*Important.*—The regulations require that no student be allowed to register after the quarter opens except by special committee action.

#### FACULTY REGULATIONS

Students are held responsible for compliance with all Faculty regulations. These regulations are published in a booklet issued to students at the time of registration.

#### REQUIREMENTS FOR GRADUATION AND DEGREES

After the completion of the prescribed course of study, including all of the required work and the requisite amount of elective work equivalent to a total of 204 (213 in June, 1920) credit hours, candidates will be recommended for graduation with the degree of Bachelor of Science.

#### PROFESSIONAL CERTIFICATES

Beginning with the year 1920-21 students entering the junior class who expect to receive the teacher's certificate from the University of Minnesota shall be registrants in the College of Education.

The University State Teachers' Certificate in Agricultural Education will be granted in 1919-20 to graduates of the College of Agriculture, Forestry, and Home Economics, who have completed fifteen hours in approved professional courses, and to graduates of the College of Education who have carried the prescribed course leading to such a certificate.



## COURSES OF STUDY

The work of the freshman year and a majority of that of the sophomore year is the same for all students. The work of the junior and senior years is arranged to permit specialization.

The College recognizes four principal groups of students:

1. Those who are preparing for general agricultural pursuits, such as county agent work, dairying, stock raising, vegetable and fruit farming, grain farming, and the management of general and specialized types of farms.

2. Those who are preparing to become specialists in any of the above lines for the practice of professional agriculture in college or experiment station. For these students graduate work after the completion of the prescribed course is advised.

3. Those who are preparing to become teachers of agriculture and manual training in secondary schools.

4. Those who expect to become specialists in some one of the special agricultural sciences such as Agricultural Biochemistry, Agricultural Economics, Entomology, Plant Breeding, Plant Pathology, Soils, etc. For thoro preparation in any of the lines listed in this group, graduate work, after the completion of the four-year course, is essential.

Groups of courses, supplementary to those required of all students, are outlined on pages 19 to 25. Some one of these should be chosen not later than the close of the freshman year.

Any student who has in mind some definite field of work not covered by these suggested lines of specialization should consult the Dean of the College for advice in the modification of his course of study or for the arrangement of a curriculum particularly suited to the vocation for which he desires to prepare himself.

After selecting or arranging such a course of study, each student should consult frequently with the head of the division, or divisions, giving the major work in his curriculum, advising particularly with reference to electives and practical vacation work which may be of value in his chosen line of specialization.

### EXPLANATION OF COURSE NUMBERS

The quarters in which courses are offered are indicated by the letters *f* (fall), *w* (winter), *s* (spring), and *su* (summer) following the course number. For example: 5*f,w,s* indicates that Course 5 is given in the fall quarter and is repeated in the winter quarter and again in the spring quarter; 5*f-6w* indicates a two-quarter course extending through the fall and winter quarters; and 5*f,w-6w,s* indicates that Course 5-6 is given in the fall and winter quarters and repeated through the winter and spring quarters.

All undergraduate courses are numbered from 1 to 100. All courses open to undergraduates and graduates are numbered from 101 to 200,

Numbers following the descriptive name of a course indicate the number of credit hours.

Course numbers in parentheses, following the number of credit hours indicate prerequisite courses.

Descriptions of the courses listed in the following outline of the curricula, together with those of additional courses offered as electives will be found on pages 27 to 74. The divisional statements are arranged alphabetically according to the names of the divisions.

One credit hour is equivalent to (1) one lecture or recitation period requiring two hours of preparation, (2) two periods of laboratory work requiring one hour of preparation, or (3) three periods of laboratory work with no preparation, each week for one quarter.

## GROUP I. GENERAL REQUIREMENTS FOR ALL STUDENTS IN AGRICULTURE

### FRESHMAN YEAR

All of the following work is required of every student except for the exemptions indicated. For some students this represents more than the regular amount of work of seventeen credit hours per quarter. In such cases those subjects listed below which cannot be taken in the freshman year must take precedence the following year. Registration for from fifteen to eighteen credit hours of work each quarter will be allowed without special permission. Care should be taken in registration to give precedence to courses offered only one quarter.

1. *Non-credit courses* required for graduation in addition to the 204 credit hours. Freshman Lectures. A course of nine lectures intended primarily to familiarize the new student with the College, college customs, and methods of procedure. Offered only in the fall quarter.
- Military Drill. Three hours per week throughout the year. Students found to be physically unfit may be required to substitute special corrective exercises in gymnasium.
- Physical Education 3w. Gymnasium and Swimming. Two hours per week for one quarter.
2. *General courses.*—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and the prerequisites must be observed. Ordinarily, if Botany is registered for in the freshman year, registration for Zoology should be postponed until the sophomore year, and vice versa.
- Agron. 1f,w,s, Farm Crops, 3.
- An. Biol. 1f,w,s-2w,s,su, General Zoology, 10. Should be postponed until the sophomore year by those who take Bot. 1-2.
- An. Husb. 1f,w, Types and Breeds of Livestock, 5.
- Bot. 1f,s-2w,f, General Botany, 10. Students entering college with a year of high-school botany satisfactory to the Department may omit Bot. 1 (see foot note on page 40) and substitute five credits elective later in their course of study. These courses should be postponed until the sophomore year by those registered for An. Biol. 1-2.
- Chem. 1f-2w-3s, General Inorganic Chemistry, 12. Students presenting a year of high-school chemistry may omit this course and register for Chem. 9-10. Those required to take this course because of inability to carry successfully Chem. 9-10 will be allowed not more than ten credits.

- Chem. 9f-10w, Advanced General Inorganic Chemistry, 10. Those required to take Chem. 1-2-3 are exempt.
- Dy. Husb. 1f,s, Elements of Dairying, 5.
- Econ. 5f,s, General Economics, 5. Open to freshmen only during their third quarter.
- Farm Eng. 10f,w, Farm Engineering, 3.
- Farm Eng. 11f,w, Applied Mathematics, 5. Students presenting a half year of high-school higher algebra may omit this course and substitute five credits elective later in their course of study.
- Hort. 90f,s, General Horticulture, 3. This course should be omitted by those intending to specialize in Horticulture or in Agricultural Education and three credits elective substituted later in their course of study.
- Phys. Educ. 1f, Personal Hygiene, 1.
- Rhet. 1f,w,s,<sup>1</sup> Rhetoric I, 3
- Rhet. 2f,w,s, Rhetoric II, 3 (Rhet. 1)
- Rhet. 3f,w,s, Rhetoric III, 3 (Rhet. 2)
- Rhet. 4f,w,s, Elementary Rhetoric, 3. Required only of those who are found to be unable to carry Rhet. 1.

#### SOPHOMORE YEAR

1. *Non-credit courses* required for graduation in addition to the 204 credit hours. Military Drill. Three hours per week throughout the year. Students found to be physically unfit may be required to substitute special corrective exercises in gymnasium.
2. *Freshman courses* which were not completed during the freshman year.
3. *General courses*.—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and the prerequisites must be observed.
 

Agr. Biochem. 7f,su-8w,su, General Agricultural Biochemistry, 10 (Chem. 10 cred.)

Bact. 6f,w,s, Elementary Bacteriology, 4

Econ. 6f,w, Agricultural Economics, 3 (Econ. 5)

Farm Eng. 3f,s, Mechanical Drawing, 3

Farm Eng. 21f-22w, Agricultural Physics, 10. Those presenting a year of high-school physics, and those selecting a line of specialization requiring Phys. 21, 41, 61 may omit this course and substitute ten credits elective later in their course of study.

Pol. Sci. 1f, American Government, 5

Rhet. 11f,w,s, Argumentation, 5 (Rhet. 3)

Rhet. 22f,w,s, Public Speaking, 5 (Rhet. 3)
4. *Special courses* as prescribed by the curriculum of the line of specialization selected. Enough of these courses should be selected to make up, with those listed in 2 and 3 above, from 15 to 18 credit hours each quarter. See special requirements on pages 19 to 25. Full work for the year (3 quarters) consists of 51 credit hours.

#### JUNIOR YEAR

1. *General course*. Soils 1s, Soils, 5 (Chem. 10 credits).
2. *Special courses* as prescribed by the curriculum of the line of specialization selected, see special requirements on pages 19 to 25.
3. *Electives*. Enough elective credits should be selected to make up, with those listed in 1 and 2 above, from 15 to 18 credit hours each quarter. Full work for the year (3 quarters) consists of 51 credit hours.

#### SENIOR YEAR

1. *Special courses* as prescribed by the curriculum of the line of specialization selected. See special requirements on pages 19 to 25.

<sup>1</sup> Special attention is called to rules on delayed credit and to regulations for students with insufficient preparation in English on page 70.

2. *Electives*.—Enough elective credits should be selected to make up, with those listed in 1 above, from 15 to 18 credit hours each quarter. Full work for the year (3 quarters) consists of 51 credit hours.

## GROUP II. SPECIAL REQUIREMENTS IN THE DIFFERENT LINES OF SPECIALIZATION (SUPPLEMENTARY TO GROUP I)

### AGRICULTURAL BIOCHEMISTRY

*General statement*.—Students specializing in Agricultural Biochemistry are advised to include among their electives the following courses or their equivalents: German 1; Rom. Lang. 4-5; Bot. 52, 54, 141, 142, 143; or Physiol. 103, 104 and as much mathematics as practicable. The following sequence of mathematics courses is suggested as desirable: Higher Algebra, Plane Trigonometry, Plane and Solid Analytical Geometry, Differential Calculus, and Integral Calculus. (See bulletin of the College of Science, Literature, and the Arts, and of the Medical School.)

#### *Sophomore year:*

- Phys. 21f,w,s,su, Elements of Mechanics, 4 (Trigonometry)
- Phys. 22f,w,s,su, Elements of Mechanics Laboratory, 1 (Phys. 21 or parallel)
- Phys. 41w, Sound and Heat, 4 (Phys. 21)
- Phys. 42w, Sound and Heat Laboratory, 1 (Phys. 22, 41 or parallel)
- Phys. 61s, Magnetism and Electricity, 4 (Phys. 21)
- Phys. 62s, Magnetism and Electricity Laboratory, 1 (Phys. 22, 61 or parallel)

#### *Junior year:*

- Agr. Biochem. 101f,su<sup>1</sup>-102w,su,<sup>1</sup> Agricultural Quantitative Analysis, 6 (Agr. Biochem. 7-8)
- Agr. Biochem. 108s,su,<sup>2</sup> Chemistry of Wheat and Wheat Products, 3 (Agr. Biochem. 3 or 7-8)
- Agr. Biochem. 110s,su,<sup>2</sup> Flour Laboratory Methods, 5 (Agr. Biochem. 101-102 or Chem. 20, 21, parallel Agr. Biochem. 108) or Agr. Biochem. 103f,su,<sup>1</sup> Dairy Chemistry, 5 (Agr. Biochem. 7-8)
- Chem. 35f-36w, Organic Chemistry, 10 (Chem. 1-2-3 or 9-10)

#### *Senior year:*

- Agr. Biochem. 111f,su-112w,su, Phytochemistry, 6 (Biology 10 cred., Organic Chemistry)
- Agr. Biochem. 113f,su-114w,su, Biochemical Laboratory Methods, 4 (Quant. Anal., Agr., Biochem. 111-112 parallel)
- Agr. Biochem. 116f,w,s,su, Chemistry of "Vitamines" and Deficiency Diseases, 3 or 5 (Agr. Biochem. 111-112 and 113-114 or Physiol. 101-102) or Agr. Biochem. 118f,w,s,su, Laboratory Problems in Biochemistry, 3 or 5 (Agr. Biochem. 111-112 and 113-114, or 110)

### AGRICULTURAL ECONOMICS

*General statement*.—Students specializing in Agricultural Economics are expected to choose their electives in Economics and some of their electives in other departments to suit the particular field of Agricultural Economics in which they are doing most of their advanced work. They should, therefore, consult the Chief of the Division before registering for their work in the junior and senior years.

#### *Sophomore year:*

- Econ. 18s, Problems in Agricultural Economics, 5 (Economics 6)

<sup>1</sup> Offered in alternate summers, offered in 1920.

<sup>2</sup> Offered in alternate summers, not offered in 1920.

*Junior year:*

- Agron. 101s, Farm Management I, 3 (Agron. 1, Econ. 6)
- Agron. 121f, Cereal Crops, 3 (Agron. 1, Bot. 10 cred.)
- An. Husb. 8s, Elements of Feeding, 3
- Econ. 19f, Principles of Agricultural Marketing, 5 (Econ. 6)
- Econ. 150s, Farm Finance, 3 (Econ. 6)
- Econ. Elective, 10
- Ent. 3f, Elementary Economic Entomology, 3 (An. Biol. 10 cred.)
- Pl. Path. 1f,su, Plant Pathology, 5 (Bot. 10 cred.)

*Senior year:*

- Agron. 102f,w,su, Farm Management II: Organization, 3 (Agron. 1, Econ. 6, An. Husb. 6 or 8, Soils 1)
- Agron. 103w,s, Farm Management II: Operation, 3 (Agron. 102)
- Econ. 11f, Statistics, 3 (Econ. 6)
- Econ. 107f, Land Tenure, 5 (Econ. 6)
- Econ. 108w, Agricultural Statistics, 5 (Econ. 11)
- Econ. Elective, 6
- Farm Mgt. Elective, 3

## AGRICULTURAL EDUCATION

*General statement.*—Students desiring to procure a State Professional Certificate should consult the Chief of the Division of Agricultural Education before registering for the work of the sophomore year.

Beginning with the year 1920-21 all juniors who expect to receive the teacher's certificate from the University of Minnesota shall be registrants in the College of Education.

*Sophomore year:*

- An. Husb. 2f, Livestock Judging, 3 (An. Husb. 1)
- Vet. Med. 8s, Veterinary Studies, 5

*Junior year:*

- Agr. Edu. 68w-69s, Home and School Gardening, 6
- Agr. Educ. 11f,w,s, Principles of Vocational Education, 3
- Agr. Educ. 21f,w, Vocational Education, 3, or Educ. 5w, American School, 3 (Psychol. 1-2)
- Agron. 11s, Farm Machinery, 3
- Agron. 121f, Cereal Crops, 3 (Agron. 1, Bot. 10 cred.)
- Agron. 122w, Corn and Potato Crops, 3 (Agron. 1, Bot. 10 cred.)
- Agron. 123s, Forage and Fiber Crops, 3 (Agron. 1, Bot. 10 cred.)
- An. Husb. 5w, Livestock Breeding, 3 (No prereq. for students in Agr. Educ.)
- An. Husb. 8s, Elements of Feeding, 3
- Dy. Husb. 101f, Milk Production, 5 (Dy. Husb. 1)
- Ent. 3f, Elementary Economic Entomology, 3 (An. Biol. 10 cred.)
- Pl. Path. 1f,su, Plant Pathology, 5 (Bot. 10 cred.)

*Senior year:*

- Agr. Educ. 41f,w-42w,s, Teaching, 6 (Agr. Educ. 131, Agron. 121, 122, 123. (See Course description.)
- Agr. Educ. 131f,w,s, Methods in Teaching High-School Agriculture, 5 (Agr. Educ. 11)
- Agr. Educ. 151f,w-152w,s, Organization and Management, 6 (Agr. Educ. 68-69)
- Agron. 102f,w,su, Farm Management II: Organization, 3 (Agron. 1, Econ. 6, An. Husb. 6 or 8, Soils 1)
- Agron. 103w,s, Farm Management II: Operation, 3 (Agron. 102)
- Farm Eng. 7w, Farm Structures, 3 (Farm Eng. 3)
- Pl. Path. 6s, Plant Pest Control, 3 (Pl. Path. 1, Ent. 3)
- Pl. Path. 9f,su, Weeds and Seed Testing, 3 (Bot. 10 cred.)
- Poultry Husb. 1f,w,s, Poultry, 3



## AGRICULTURAL EDUCATION—MANUAL TRAINING

*General statement.*—Students desiring to procure a State Professional Certificate should consult the Chief of the Agricultural Education Division before registering for the work of the sophomore year.

Beginning with the year 1920-21 all juniors who expect to receive the teachers' certificate from the University of Minnesota will be registrants in the College of Education.

In order to be certified for the industrial certificate in manual training and agriculture, the following courses must be completed in addition to the required work outlined below: An. Husb. 5w, 8s; Poultry Husb. 1f,w,s, and Ent. 16s.

*Sophomore year:*

An. Husb. 2f, Livestock Judging, 3 (An. Husb. 1)  
Vet. Med. 8s, Veterinary Studies, 5

*Junior year:*

Agr. Educ. 68w-69s, Home and School Gardening, 6  
Agr. Educ. 11f,w,s, Principles of Vocational Education, 3  
Agr. Educ. 21f,w, Vocational Education, 3 or Educ. 5w, American School, 3 (Psychol. 1-2)  
Agron. 11s, Farm Machinery, 3  
Agron. 121f, Cereal Crops, 3 (Agron. 1, Bot. 10 cred.)  
Agron. 122w, Corn and Potato Crops, 3 (Agron. 1, Bot. 10 cred.)  
Agron. 123s, Forage and Fiber Crops, 3 (Agron. 1, Bot. 10 cred.)  
Dy. Husb. 101f, Milk Production, 5 (Dy. Husb. 1)  
Ent. 3f, Elementary Economic Entomology, 3 (An. Biol. 10 cred.)  
Pl. Path. 1f,su, Plant Pathology, 5 (Bot. 10 cred.)

*Senior year:*

Agr. Educ. 41f,w-42w,s, Teaching, 6 (Agr. Educ. 131, Agron. 121, 122, 123. (See course description.)  
Agr. Educ. 131f,w,s, Methods in Teaching High-School Agriculture, 5 (Agr. Educ. 11)  
Agr. Educ. 133f,w,s, Organization and Methods for Manual Training, 3 (Instructor's permission)  
Agr. Educ. 151f,w-152w,s, Organization and Management, 6 (Agr. Educ. 68-69)  
Agron. 102f,w,su, Farm Management II: Organization, 3 (Agron. 1, Econ. 6, An. Husb. 6 or 8, Soils 1)  
Agron. 103w,s, Farm Management II: Operation, 3 (Agron. 102)  
Farm Eng. 4w, Blacksmithing, 3 or Farm Eng. 13f,s, Farm Motors, 3  
Farm Eng. 5f, Carpentry, 3  
Farm Eng. 7w, Farm Structures, 3 (Farm Eng. 3)  
Advanced Wood Work or Advanced Drawing, 3

## AGRONOMY

*Sophomore year:*

Bot. 7s, Taxonomy of Flowering Plants, 5 (Bot. 2)  
Bot. Elective, 5

*Junior year:*

Agr. Biochem. 15f, Principles of Animal Nutrition, 3 (Agr. Biochem. 7-8)  
Agron. 121f, Cereal Crops, 3 (Agron. 1, Bot. 10 cred.)  
Agron. 122w, Corn and Potato Crops, 3 (Agron. 1, Bot. 10 cred.)  
Agron. 123s, Forage and Fiber Crops, 3 (Agron. 1, Bot. 10 cred.)  
Bot. 52f, Plant Physiology, 5 (Bot. 15 cred.)  
Ent. 3f, Elementary Economic Entomology, 3 (An. Biol. 10 cred.)  
Pl. Path. 1f,su, Plant Pathology, 5 (Bot. 10 cred.)  
Vet. Med. 8s, Veterinary Studies, 5

*Senior year:*

- Agron. 102f,w,su, Farm Management II: Organization, 3 (Agron. 1, Econ. 6, An. Husb. 6 or 8, Soils 1)  
 Agron. 103w,s, Farm Management II: Operation, 3 (Agron. 102)  
 Agron. 131f, Principles of Genetics, 3 (Bot. 10 cred., An. Biol. 10 cred.)  
 Agron. 132s,su, Farm Crops Plant Breeding, 3 (Agron. 131)  
 Agron. Elective, 3  
 An. Husb. 6w, Livestock Feeding, 5 (Agr. Biochem. 15)  
 Farm Eng. 7w, Farm Structures, 3 (Farm Eng. 3)  
 Pl. Path. 9f,su, Weeds and Seed Testing, 3 (Bot. 10 cred.)

## ANIMAL HUSBANDRY

*Sophomore year:*

- An. Husb. 2f, Livestock Judging, 3 (An. Husb. 1)  
 Vet. Med. 2f, Anatomy of Domestic Animals, 5

*Junior year:*

- Agr. Biochem. 15f, Principles of Animal Nutrition, 3 (Agr. Biochem. 7-8)  
 Agron. 131f, Principles of Genetics, 3 (Bot. 10 cred., An. Biol. 10 cred.)  
 An. Husb. 3f-4w, Market Classes of Livestock, 6 (An. Husb. 2)  
 Dy. Husb. 101f, Milk Production, 5 (Dy. Husb. 1)  
 Poultry Husb. 1f,w,s, Poultry, 3  
 Vet. Med. 3w-4s, Comparative Physiology, 6 (Vet. Med. 2)

*Senior year:*

- Agron. 102f,w,su, Farm Management II: Organization, 3 (Agron. 1, Econ. 6, An. Husb. 6 or 8, Soils 1)  
 Agron. 103w,s, Farm Management II: Operation, 3 (Agron. 102)  
 An. Husb. 5w, Livestock Breeding, 3 (Vet. Med. 6, Agron. 131)  
 An. Husb. 6w, Livestock Feeding, 5 (Agr. Biochem. 15)  
 An. Husb. 7f, Meats, 3 (Agr. Biochem. 15)  
 An. Husb. 9s, Pedigree and Herd Book Work, 3 (An. Husb. 5)

*One of the following:*

- An. Husb. 102s, Horse Husbandry, 3 (An. Husb. 3-4, 5, 6)  
 An. Husb. 103s, Beef Cattle Husbandry, 3 (An. Husb. 3-4, 5, 6)  
 An. Husb. 104s, Sheep Husbandry, 3 (An. Husb. 3-4, 5, 6)  
 An. Husb. 105s, Swine Husbandry, 3 (An. Husb. 3-4, 5, 6)  
 An. Husb. Elective, 6  
 Farm Eng. 7w, Farm Structures, 3 (Farm Eng. 3)  
 Vet. Med. 6f, Physiology and Hygiene of Breeding, 3 (Vet. Med. 3-4)  
 Vet. Med. 12w, Infectious Diseases, 3 (Vet. Med. 3-4, Bact. 6)  
 Vet. Med. 13s, Non-infectious Diseases, 3 (Vet. Med. 3-4)

## DAIRY HUSBANDRY

*General statement.*—Two lines of specialization are recognized in Dairy Husbandry:

(a) Production, and (b) Dairy Products. Those specializing in Dairy Production may omit Dy. Husb. 3, 4, 5 and Agr. Biochem. 103. Those specializing in Dairy Products may omit An. Husb. 5; Dy. Husb. 104; Vet. Med. 6, 12, 13; from the required courses listed below.

The following electives are recommended: Econ. 18, 19; Poul. Husb. 1; Pub. and Rur. Journ. 10-11-12. Those specializing in Dairy Products are also advised to take Agr. Biochem. 101-102.

*Sophomore year:*

- An. Husb. 2f, Livestock Judging, 3 (An. Husb. 1)  
 Dy. Husb. 2w, Dairy Bacteriology, 3 (Bact. 6)  
 Vet. Med. 2f, Anatomy of Domestic Animals, 5

*Junior year:*

- Agr. Biochem. 15f, Principles of Animal Nutrition, 3 (Agr. Biochem. 7-8)  
 Agron. 131f, Principles of Genetics, 3 (Bot. 10 cred., An. Biol. 10 cred.)

- An. Husb. 3f-4w, Market Classes of Livestock, 6 (An. Husb. 2)  
 Dy. Husb. 3f, Factory Management, 5 (Dy. Husb. 1, 2)  
 Dy. Husb. 4su, Cheese Factory Practice, 3 (Dy. Husb. 1, 3) or Dy. Husb. 5 su,  
 Creamery Practice (Dy. Husb. 1, 3)  
 Dy. Husb. 101f, Milk Production, 5 (Dy. Husb. 1)  
 Dy. Husb. 102s, Market Milk, 3 (Dy. Husb. 1, 2)  
 Vet. Med. 3w-4s, Comparative Physiology, 6 (Vet. Med. 2)

*Senior year:*

- Agr. Biochem. 103f,su, Dairy Chemistry, 5 (Agr. Biochem. 7-8)  
 Agron. 102f,w,su, Farm Management II: Organization, 3 (Agron. 1, Econ. 6,  
 An. Husb. 6 or 8, Soils 1)  
 Agron. 103w,s, Farm Management II: Operation, 3 (Agron. 102)  
 An. Husb. 5w, Livestock Breeding, 3 (Vet. Med. 6, Agron. 131)  
 Dy. Husb. 103w, Dairy Stock Feeding, 3 (Agr. Biochem. 15, Dy. Husb. 101)  
 Dy. Husb. 104s, Advanced Study of Dairy Breeds, 3 (Dy. Husb. 1, 101)  
 Dy. Husb. 105f, Seminar I, 1 (3 courses in Dy. Husb.)  
 Dy. Husb. 106w, Seminar II, 1 (3 courses in Dy. Husb.)  
 Dy. Husb. 107s, Seminar III, 1 (3 courses in Dy. Husb.)  
 Farm Eng. 7w, Farm Structures, 3 (Farm Eng. 3)  
 Vet. Med. 6f, Physiology and Hygiene of Breeding, 3 (Vet. Med. 3-4)  
 Vet. Med. 12w, Infectious Diseases, 3 (Vet. Med. 3-4, Bact. 6)  
 Vet. Med. 13s, Non-infectious Diseases, 3 (Vet. Med. 3-4)

## ENTOMOLOGY AND ECONOMIC ZOOLOGY

*General statement.*—Students planning to specialize in Entomology and Economic Zoology are advised to register for the required course in Animal Biology during their freshman year. It is believed that the best interests of such students will be served by leaving a margin for the choice of approved electives during the junior and senior years. Students planning to fit themselves for positions along entomological lines should consult the Chief of the Division early in their course. A reading knowledge of French and German is desirable and is essential to graduate work.

*Sophomore year:*

- Ent. 1f, s,su, Introductory Entomology, 5 (An. Biol. 10 cred.)  
 Ent. 2w,su, Economic Entomology, 5 (Ent. 1)

*Junior year:*

- Agron. Elective, 3  
 Ent. 125f-126w-127s, Advanced General Entomology, 9 (Ent. 1 and 2, or 37-38-39)  
 Ent. or Hort. Elective, 3  
 Hort. Elective, 3  
 Pl. Path. 1f,su, Plant Pathology, 5 (Bot. 10 cred.)

*Senior year:*

- Ent. 117f-118w-119s, General Ecology of Insects, 9 (Ent. 1 and 2, or 37-38-39)  
 Pl. Path. 14s, Plant Disease Control, 5 (Pl. Path. 1, Ent. 1 or 3)  
 Pl. Path. 108f-109w, Methods, 6 (Pl. Path. 1, Bact. 6)

## FARM MANAGEMENT

*Sophomore year:*

- Econ. 18s, Problems in Agricultural Economics, 5 (Econ. 6)

*Junior year:*

- Agr. Biochem. 15f, Principles of Animal Nutrition, 3 (Agr. Biochem. 7-8)  
 Agron. 101s, Farm Management I, 3 (Agron. 1, Econ. 6)  
 Agron. 121f, Cereal Crops, 3 (Agron. 1, Bot. 10 cred.)  
 Agron. 122w, Corn and Potato Crops, 3 (Agron. 1, Bot. 10 cred.)  
 Agron. 123s, Forage and Fiber Crops, 3 (Agron. 1, Bot. 10 cred.)  
 Ent. 3f, Elementary Economic Entomology, 3 (An. Biol. 10 cred.)  
 Pl. Path. 1f,su, Plant Pathology, 5 (Bot. 10 cred.)

Vet. Med. 8s, Veterinary Studies, 5

*Senior year:*

Agron. 102f,w,su, Farm Management II: Organization, 3 (Agron. 1, Econ. 6, An. Husb. 6 or 8, Soils 1)  
 Agron. 103w,s, Farm Management II: Operation, 3 (Agron. 102)  
 An. Husb. 6w, Livestock Feeding, 5 (Agr. Biochem. 15)  
 Econ. Elective, 5  
 Farm Eng. 7w, Farm Structures, 3 (Farm Eng. 3)  
 Farm Mgt. Elective, 3  
 Pl. Path. 9f,su, Weeds and Seed Testing, 3 (Bot. 10 cred.)

### HORTICULTURE

*General statement.*—Electives should include courses in Botany, Economics, Entomology, and Plant Pathology

*Sophomore year:*

For. 21w, Tree Crops, 3  
 Hort. 32s, Vegetable Gardening, 3 (Bot. 10 cred.)

*Junior year:*

An. Husb. 8s, Elements of Feeding, 3  
 Bot. Elective, 10  
 Ent. 1f,s,su, Introductory Entomology, 5 (An. Biol. 10 cred.)  
 Ent. 2w,su, Economic Entomology, 5 (Ent. 1)  
 Hort. 6s, Principles of Fruit Growing, 3 (Bot. 10 cred.)  
 Hort. Elective, 3  
 Pl. Path. 1f,su, Plant Pathology, 5 (Bot. 10 cred.)  
 Pl. Path. 14s, Plant Disease Control, 5 (Pl. Path. 1, Ent. 1 or 3)

*Senior year:*

Agron. 102f,w,su, Farm Management II: Organization, 3 (Agron. 1, Econ. 6, An. Husb. 6 or 8, Soils 1)  
 Agron. 103w,s, Farm Management II: Operation, 3 (Agron. 102)  
 Hort. 107f, Orchard Management, 3 (Hort. 90 or 6) or Hort. 131f, Advanced Market Gardening, 3 (Hort. 32)  
 Hort. Elective, 9  
 Hort. 109f, Principles of Genetics, 3 (Bot. 10 cred., An. Biol. 10 cred.)  
 Hort. 110w, Fruit Breeding, 3 (Hort. 109)

### PLANT PATHOLOGY

*General statement.*—Students specializing in Plant Pathology should consult the Chief of the Division with reference to requirements in mathematics before registering for the work of the sophomore year.

*Sophomore year:*

Bot. Elective, 10

*Junior year:*

Ent. 3f, Elementary Economic Entomology, 3 (An. Biol. 10 cred.)  
 Phys. 21f,w,s,su, Elements of Mechanics, 4 (Trigonometry)  
 Phys. 22f,w,s,su, Elements of Mechanics Laboratory, 1 (Phys. 21 or parallel)  
 Phys. 41w, Sound and Heat, 4 (Phys. 21)  
 Phys. 42w, Sound and Heat Laboratory, 1 (Phys. 22, 41 or parallel)  
 Phys. 61s, Magnetism and Electricity, 4 (Phys. 21)  
 Phys. 62s, Magnetism and Electricity Laboratory, 1 (Phys. 22, 61 or parallel)  
 Pl. Path. 1f,su, Plant Pathology, 5 (Bot. 10 cred.)  
 Pl. Path. 14s, Plant Disease Control, 5 (Pl. Path. 1, Ent. 1 or 3)

*Senior year:*

Agr. Biochem. 111f,su-112w,su, Phytochemistry, 6 (Biol. 10 cred, Organic Chemistry)  
 Agron. 131f, Principles of Genetics, 3 (Bot. 10 cred., An. Biol. 10 cred.)  
 Bot. or Ent. Elective, 10  
 Hort. Elective, 3

- Pl. Path. 108f-109w, Methods, 6 (Pl. Path. 1, Bact. 6)  
 Pl. Path. 110s, Principles of Pathology, 3 (Pl. Path. 1, Bact. 6)

## SOILS

*General statement.*—Students specializing in Soils should consult the Chief of the Division with reference to requirements in mathematics before registering for the work of the sophomore year.

*Sophomore year:*

- Chem. 12s-13f, Qualitative Chemical Analysis, 10 (Chem. 9-10)  
 Geol. 1f,s-2w,su, General Geology, 10

*Junior year:*

- An. Husb. 8s, Elements of Feeding, 3  
 Chem. 20w, Quantitative Analysis, 5 (Chem. 12-13)  
 Chem. 35f-36w, Organic Chemistry, 10 (Chem. 1-2-3 or 9-10)  
 Phys. 21f,w,s,su, Elements of Mechanics, 4 (Trigonometry)  
 Phys. 22f,w,s,su, Elements of Mechanics Laboratory, 1 (Phys. 21 or parallel)  
 Phys. 41w, Sound and Heat, 4 (Phys. 21)  
 Phys. 42w, Sound and Heat Laboratory, 1 (Phys. 22, 41 or parallel)  
 Phys. 61s, Magnetism and Electricity, 4 (Phys. 21)  
 Phys. 62s, Magnetism and Electricity Laboratory, 1 (Phys. 22, 61 or parallel)  
 Pl. Path. 1f,su, Plant Pathology, 5 (Bot. 10 cred.)

*Senior year:*

- Agr. Biochem. 111f,su-112w,su, Phytochemistry, 6 (Biol. 10 cred., Organic Chemistry)  
 Agron. 102f,w,su, Farm Management II: Organization, 3 (Agron. 1, Econ. 6, An. Husb. 6 or 8, Soils 1)  
 Agron. 103w,s, Farm Management II: Operation, 3 (Agron. 102)  
 Ent. 3f, Elementary Economic Entomology, 3 (An. Biol. 10 cred.)  
 Geol. 21w-22s, Elements of Mineralogy, 10. (See course description.)  
 Soils 101f, Chemical Analysis of Soils, 5 (Soils 1, Chem. 20)  
 Soils 102f,w,s, Special Problems in Soils,<sup>1</sup> (Soils 101, 103)  
 Soils 103f, Mechanical Analysis of Soils, 3 (Soils 1)  
 Soils 105w, Minnesota Soils, 3 (Soils 1)

## ELECTIVES

Students should consult with the division in which they are specializing with reference to the elective courses which must be chosen to make up the 204 credit hours required for graduation.

Only a limited number of elective courses are open to freshmen. First-year students, who for any reason are unable to follow the regular curriculum, are advised to fill their program with a required course from the sophomore schedule, if possible, and postpone the choice of electives until the sophomore year. This plan will enable the student to obtain a better viewpoint from which to select his electives and allow a wider range of subjects from which to choose.

In selecting electives, note particularly (a) prerequisites, (b) classes of students (fr., soph., jr., or sr.) to which courses are offered, (c) number of credits, (d) quarter or quarters offered, and be sure that provision is made in registration for the proper sequence of continuation courses.

<sup>1</sup> Credit according to amount of work.



## FRESHMAN ELECTIVES

The following divisions and departments offer elective work to freshmen. For the description of available courses see pages 27 to 74, and for departments marked S., L., and A., see bulletin of the College of Science, Literature, and the Arts.

Farm Engineering

Forestry

German

History (S., L., and A.)

Home Economics

Mathematics (S., L., and A.)

Poultry Husbandry

Romance Languages

## SOPHOMORE, JUNIOR, AND SENIOR ELECTIVES

Nearly all of the divisions offer elective work to sophomores, juniors, and seniors.

Elective courses in the college of Science, Literature, and the Arts, are separated into Junior College courses, open to freshmen and sophomores, and Senior College courses, open to juniors and seniors. In addition to satisfying other prerequisites an average grade of C must be maintained for the first two years in order to register for a Senior College elective.

## DESCRIPTION OF COURSES

For explanation of course numbers and credits see page 16.

### AGRICULTURAL BIOCHEMISTRY

Professor ROSS A. GORTNER; Associate Professors CLYDE H. BAILEY, LEROY S. PALMER; Assistant Professors R. ADAMS DUTCHER, CLARENCE A. MORROW, JOHN J. WILLAMAN.

*General statement.*—This Division offers two types of work, namely, courses in those phases of chemistry which have special application in agriculture or home economics for students whose major work is in other divisions; and courses designed to train chemists for research or instruction in the special field of Agricultural Biochemistry. For specialization in this Division, see special requirements in Course of Study.

#### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
7f,su <sup>1</sup> -8w, su. <sup>2</sup>	General Agricultural Biochemistry.....	10	Soph., jr., sr.	Chem. 10 cred.
15f,su. <sup>1</sup>	Principles of Animal Nutrition.	3	Soph., jr., sr.	7-8
<i>Advanced Courses</i>				
101f,su <sup>1</sup> - 102w,su.	Agricultural Quantitative Analysis.....	6	Jr., sr.	7-8
103f,su. <sup>1</sup>	Dairy Chemistry.....	5	Jr., sr.	7-8
106f.	Agricultural Products and By-Products.....	5	Sr.	101-102
108s,su. <sup>2</sup>	Chemistry of Wheat and Wheat Products.....	3	Jr., sr.	7-8
110s,su. <sup>2</sup>	Flour Laboratory Methods....	5	Jr., sr.	101-102, or Chem. 131-132, parallel 108
111f,su- 112w,su.	Phytochemistry.....	6	Sr.	Biol.10 cred., Org.Chem.
113f,su- 114w,su.	Biochemical Laboratory Methods.....	4	Sr.	Quant. Anal., parallel 111-112
116f,w,s su.	Chemistry of "Vitamines" and Deficiency Diseases.....	3 or 5	Sr.	111-112, 113-114, or Physiol. 101-102, or 7-8 and 15.
118f,w,s, su.	Laboratory Problems in Biochemistry.....	3 or 5	Sr.	111-112, 113-114; or 103 or 110.

<sup>1</sup> Offered in alternate summers, offered in 1920.

<sup>2</sup> Offered in alternate summers, not offered in 1920.

## INTRODUCTORY COURSES

7f,su<sup>1</sup>-8w,su.<sup>2</sup> GENERAL AGRICULTURAL BIOCHEMISTRY. A lecture and laboratory course involving a qualitative and quantitative study of the types of organic and inorganic compounds found in plants and animals and of the chemical changes involved in metabolism, growth, and maintenance. DUTCHER.

15f,su.<sup>1</sup> PRINCIPLES OF ANIMAL NUTRITION. A course consisting of lectures, recitations, and collateral reading emphasizing the chemical and physiological principles underlying digestion, metabolism, utilization of feeds, maintenance, growth, fattening, milk production, vitamin hypothesis, and deficiency diseases. DUTCHER.

## ADVANCED COURSES

101f,su<sup>1</sup>-102w,su.<sup>1</sup> AGRICULTURAL QUANTITATIVE ANALYSIS. The estimation of inorganic and organic constituents of agricultural products, the proximate analysis of foods and feeding stuffs, the use of the polariscope, immersion refractometer, colorimeter and nephelometer, viscosimeter, and other special apparatus. MORROW.

103f,su.<sup>1</sup> DAIRY CHEMISTRY. Lectures, library, and laboratory work involving a study of the chemical composition of dairy products and the quantitative analysis of these products as practiced in control laboratories, together with qualitative examination for preservatives and adulterations. PALMER.

106f. AGRICULTURAL PRODUCTS AND BY-PRODUCTS. The composition of the principal products and by-products of agriculture and their utilization as raw material in various industries, and the methods of chemical control work in these industries. BAILEY.

108s,su.<sup>2</sup> CHEMISTRY OF WHEAT AND WHEAT PRODUCTS. A lecture course, with collateral library reference work, on the chemical technology of the production and milling of wheat and the conversion of its products into human food. BAILEY.

110s,su.<sup>2</sup> FLOUR LABORATORY METHODS. A laboratory course in methods of analyses of wheat and its products; milling tests of wheat, baking and special tests of flour. Designed to train students for research and control work in the cereal industry. BAILEY.

111f,su-112w,su. PHYTOCHEMISTRY. Advanced course dealing with the colloidal state, and the chemistry of proteins, carbohydrates, glucosides, tannins, fats, plant acids, enzymes and pigments and their physico-chemical relations to the vital processes involved in growth and nutrition. MORROW.

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<sup>1</sup> Offered in alternate summers, offered in 1920.

<sup>2</sup> Offered in alternate summers, not offered in 1920.

- 113f,su-114w,su. BIOCHEMICAL LABORATORY METHODS. A laboratory course paralleling the lectures in 111, using recent methods for the investigation of biologically important compounds, with especial reference to the detection and estimation of such compounds in cells or tissues. MORROW.
- 116f,w,s,su. THE CHEMISTRY OF "VITAMINES" AND DEFICIENCY DISEASES. Lectures, consultations, and library work on special nutritional problems accompanied by chemical and biological studies of food materials from the standpoint of their "vitamine" content. DUTCHER.
- 118f,w,s,su. LABORATORY PROBLEMS IN BIOCHEMISTRY. Special laboratory work in the preparation and isolation of pure compounds which occur in living cells, the study of biochemical reactions, and special methods of identification or determination of biochemical products. GORTNER, BAILEY, PALMER, DUTCHER, MORROW, WILLAMAN.

### AGRICULTURAL ECONOMICS

See Economics (page 45).

### AGRICULTURAL EDUCATION

Professors ASHLEY V. STORM, DEXTER D. MAYNE; Assistant Professors WILLIAM P. DYER, ALBERT M. FIELD; Instructor JOHN V. ANKENY; Extension Specialists THEODORE A. ERICKSON, GEORGE F. HOWARD.

*General statement.*—For specialization in this Department, see special requirements in Course of Study.

#### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
11f,w,s.	Principles of Vocational Education.....	3	Jr., sr. <sup>2</sup>	None
21f,w	Vocational Education.....	3	Jr., sr. <sup>2</sup>	None
41f,w-42w, s.	Teaching.....	6	Sr. <sup>2</sup>	131, Agron. 121, 122, 123, see course description
63f-64w- 65s.	General Agriculture.....	9	All	None
68w-69s.	Home and School Gardening...	6	Jr., sr. <sup>2</sup>	None
<i>Advanced Courses</i>				
121w.	Teachers' Course—Home and School Garden Supervision...	2	Approval of Division	
131f,w,s.	Methods in Teaching High-School Agriculture.....	5	Jr., <sup>1</sup> sr. <sup>2</sup>	11
133f,w,s.	Organization and Methods for Manual Training.....	3	Jr., sr.	11

<sup>1</sup> Open to juniors on approval of the Chief of the Division.

<sup>2</sup> Offered only to those preparing to teach.

No.	Title	Credits	Offered to	Prereq. courses
151f,w-				
152w,s.	Organization and Management.	6	Sr. <sup>2</sup>	68-69
153su.	Consolidated Rural Schools . . .	3	All <sup>2</sup>	None
161f-162w-				
163s.	Fundamentals of Agriculture . . .	9	Jr., sr. <sup>2</sup>	None
171f,w.	Extension Work . . . . .	3	Sr.	None
173f,w,s.	History of Agriculture . . . . .	3	Soph., jr., sr.	None
175f,w.	Visual Presentation . . . . .	3	Jr., sr.	None
176s.	Advanced Visual Presentation . .	3	Jr., sr.	175
181w.	Agricultural Statistics and Graphic Representation . . . .	3	Soph., jr., sr.	None
191f-192w-				
193s.	Seminar in Agricultural Educa- tion . . . . .	3-9	Sr. <sup>2</sup>	None

<sup>2</sup> Offered only to those preparing to teach.

#### INTRODUCTORY COURSES

- 11f,w,s. **PRINCIPLES OF VOCATIONAL EDUCATION.** The fundamental principles upon which education is based. Emphasis is placed on those phases which are most closely related to vocational education. DYER.
- 21f,w. **VOCATIONAL EDUCATION.** A short history of vocational education; present status in Europe and the United States; manual training, and home arts in an educational system; place of agriculture in the public schools with special reference to Minnesota. MAYNE.
- 41f,w-42w,s. **TEACHING<sup>1</sup>.** Observation of regular classes; interpretation of class practices; preparation of lesson plans and actual teaching of classes under careful supervision in recitation and laboratory; criticism and discussion of plans, methods, and results of student's teaching. Students are admitted to this course only when recommended by the faculty of the division in which they are specializing and when accepted by the Division of Agricultural Education. STORM, ANKENY, DYER, FIELD.
- 63f-64w-65s. **GENERAL AGRICULTURE.** For students specializing in such divisions as Agricultural Biochemistry, Entomology, and Economic Zoology, Plant Pathology, and in other colleges. A series of units by division chiefs and other agricultural specialists. STORM, MAYNE.
- 68w-69s. **HOME AND SCHOOL GARDENING.** Lecture and laboratory. The elements of horticulture as applied to high-school instruction, plant propagation, fruit growing, home gardening, school gardening, and the planning of home and school grounds. Same as Hort. 94-95. FIELD, BRIERLEY.

#### ADVANCED COURSES

- 121w. **TEACHERS' COURSE—HOME AND SCHOOL GARDEN SUPERVISION.** A lecture and laboratory course designed to give teachers the prepara-

<sup>1</sup> Students who are prepared may be required to do their teaching in manual training.



tion necessary for the proper planning, management, and supervision of home and school gardens. FIELD, ANKENY.

131f,w,s. METHODS IN TEACHING HIGH-SCHOOL AGRICULTURE. Fundamental elements of method in teaching as related to teaching agriculture in high school. Organizing subject-matter of daily work; selection and manipulation of devices. Classroom and laboratory method. Specific plans for teaching secondary agriculture. FIELD.

133f,w,s. ORGANIZATION AND METHODS FOR MANUAL TRAINING. ....

151f,w-152w,s. ORGANIZATION AND MANAGEMENT. Organization and management of work in secondary schools, particularly of Minnesota, with special reference to agricultural work, courses of study, programs, equipment, laboratory and class management, extension work, plots, and coördination of work. STORM, DYER.

153su. CONSOLIDATED RURAL SCHOOLS. Building arrangements, selection of teachers, equipment, transportation of pupils, health supervision, home project work, and other problems in organization and management of consolidated rural schools from the viewpoint of the special needs of rural life. DYER.

161f-162w-163s. FUNDAMENTALS OF AGRICULTURE. Essential for principals and superintendents of schools in which agriculture is taught, and valuable for students of other colleges whose time for agriculture is limited. Agricultural college experts will give work in their special fields. STORM, .....

171f,w. EXTENSION WORK. Federal, state, and local extension aims, organization. Assembling and use of extension data and equipment. Development of extension methods especially as applied to the work in Minnesota. ....

173f,w,s. HISTORY OF AGRICULTURE. A history of agricultural progress with special reference to the greater movements and to sources from which modern agriculture has received its most valuable acquisitions. Comparisons of our own agriculture with that of other countries. DYER.

175f,w. VISUAL PRESENTATION. To prepare persons for presenting materials by means of slides, films, charts, etc. Students assisted in assembling materials for their own use and in acquiring skill and technique in preparation and operation of various mediums. ANKENY.

176s. ADVANCED VISUAL PRESENTATION. Continuation of 175. Further work in design and construction of charts and lantern slides. Special study of motion picture machines. Actual practice in effective use of visual aids in lecture and recitation. ANKENY.

181. AGRICULTURAL STATISTICS AND GRAPHIC REPRESENTATION. Course teaches application of statistical methods to agriculture and different means of representing agricultural statistics graphically. Of value to all students to enable them to interpret, present, and use agricultural statistics and graphic representations. —————

191f-192w-193s. SEMINAR IN AGRICULTURAL EDUCATION. Critical studies of important problems in agricultural education; opportunity for individual investigation and research; review and interpretation of current educational literature. STORM, FIELD.

### AGRONOMY AND FARM MANAGEMENT

Professor ANDREW BOSS; Associate Professors ALBERT C. ARNY, HERBERT K. HAYES, FRANCIS W. PECK;<sup>1</sup> Assistant Professors LOUIS B. BASSETT, RALPH J. GARBER, FREDERICK H. STEINMETZ; Extension Specialists WILLIAM L. CAVERT, THOMAS B. MCCULLOUGH.

*General statement.*—For specialization in this Department, see special requirements in Course of Study.

#### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f,w,s,su.	Farm Crops.....	3	All	None
11s.	Farm Machinery.....	3	Jr., sr.	None
<i>Advanced Courses</i>				
101s.	Farm Management I.....	3	Jr., sr.	1, Econ. 6
102f,w,su.	Farm Management II: Organization.....	3	Sr.	1, Econ. 6, An. Husb 6 or 8, Soils 1
103w,s.	Farm Management II: Operation.....	3	Sr.	102
104s.	Farm Management III.....	3	Sr.	101, 103
121f.	Cereal Crops.....	3	Jr., sr.	1, Bot. 10 cred.
122w.	Corn and Potato Crops.....	3	Jr., sr.	1, Bot. 10 cred.
123s.	Forage and Fiber Crops.....	3	Jr., sr.	1, Bot. 10 cred.
131f.	Principles of Genetics.....	3	Jr., sr.	Bot. 10 cred., An. Biol. 10 cred.
132s,su.	Farm Crops Plant Breeding....	3	Jr., sr.	131

#### INTRODUCTORY COURSES

1f,w,s,su. FARM CROPS. An elementary study of the important field crops of the United States with emphasis upon those of local importance; distribution, economic importance, agricultural classification, cultural methods, and principles of improvement. GARBER, STEINMETZ.

11s. FARM MACHINERY. Lectures and laboratory work covering classification, mechanical construction, adjustment, and operation of the different kinds of farm machinery. BASSETT.

<sup>1</sup> On leave of absence.

## ADVANCED COURSES

- 101s. FARM MANAGEMENT I. Farm Records—A study of simple farm accounting and of the forms and methods employed in making cost of production studies, and farm management surveys. Practice given in the art of record keeping and accounting. —————
- 102f,w,su. FARM MANAGEMENT II: ORGANIZATION. A course in which the business side of farming is emphasized. Special attention is given to farm organization and equipment. BOSS.
- 103w,s. FARM MANAGEMENT II: OPERATION. Continuation of 102, Special attention is given to farm operation. BOSS.
- 104s. FARM MANAGEMENT III. An advanced seminar course, including cost of production studies, farm business analyses, and farm practices. BOSS.
- 121f. CEREAL CROPS. An advanced study of the cereal crops. Structure, group classification, improvement, growing and utilization. Brief score-card practice and a limited amount of placing on intrinsic value included. ARNY.
- 122w. CORN AND POTATO CROPS. A study of the corn and potato crops similar to that outlined for Course 121. ARNY.
- 123s. FORAGE AND FIBRE CROPS. A study of forage plants through assigned reading, laboratory and field work. Following the study of each crop some attention is given to score-card practice and comparative placing of representative samples. ARNY.
- 131f. PRINCIPLES OF GENETICS. Lectures and laboratory work designed to familiarize the student with the underlying principles of breeding. Heredity variation, biometry, and evolution are emphasized. Same as Hort. 109. HAYES, DORSEY.
- 132s,su. FARM CROPS PLANT BREEDING. Applied genetics is emphasized. Methods of breeding each of the important agricultural and horticultural crops with special attention to experiment station investigations and to the methods used by plant breeders. HAYES, GARBER.

## ANIMAL BIOLOGY

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors HENRY C. NACHTRIEB, WILLIAM A. RILEY, THOMAS S. ROBERTS, CHARLES P. SIGERFOOS; Associate Professor HAL DOWNEY; Assistant Professors ROYAL N. CHAPMAN, ELMER J. LUND, OSCAR W. OESTLUND; Instructors GEORGE D. ALLEN, ADOLPH RINGOEN.

*General statement.*—Courses in this Department are closely correlated with those offered by the Division of Entomology and Economic Zoology

of the College of Agriculture, Forestry, and Home Economics. For courses of that Division, see page 50.

COURSES				
No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f,w,s-2w, s,su.	General Zoology.....	10 <sup>1</sup>	All	None
9f,s-10w.	Histology and Embryology....	10 <sup>1</sup>	Soph., jr., sr.	1-2
17f-18w.	General Physiology.....	10 <sup>1</sup>	Soph., jr., sr.	15 cred. or 10 cred. and Chem. or Phys. 10 cred.
23s.	Morphogenesis and Behavior of Organisms.....	5	All	15 cred. or 10 cred. and Chem. or Phys. 10 cred.
27s.	Comparative Anatomy.....	5	All	1-2
35s.	General Embryology.....	5	All	1-2
37f-38w.	General Entomology.....	10 <sup>1</sup>	Soph., jr., sr.	1-2
43s,su.	Introductory Entomology....	5	All	1-2
44f,s.	Animal Parasites.....	5	Soph., jr., sr.	1-2
45w,su.	Insects and Disease.....	3	Soph., jr., sr.	44
59s.	General Ecology.....	5	All	1-2
<i>Advanced Courses</i>				
107s.	Protozoology.....	3	Jr., sr.	15 cred. incl. 1-2
109f-110w.	General Physiology.....	10 <sup>1</sup>	Jr., sr.	20 cred.
114w-115s.	Ornithology.....	6 <sup>1</sup>	Jr., sr.	1-2
117f-118w- 119s.	Ecology of Insects.....	9 <sup>1</sup>	Jr., sr.	43
124 su.	Advanced Ecology.....	5	Jr., sr.	117-118-119
125f-126w- 127s.	Advanced Entomology.....	9 <sup>1</sup>	Jr., sr.	37-38 or 43
130w.	Biology and Taxonomy of the Aphididae.....	3	Jr., sr.	20 cred. incl. 1-2.
139s,su.	Histology and Development of Insects.....	5	Soph., jr., sr.	37-38 or 43
182w.	Genetics and Eügenics.....	3	Jr., sr.	9-10

For additional courses, see the bulletin of the College of Science, Literature, and the Arts.

<sup>1</sup> The full course must be completed before credit will be allowed.

#### INTRODUCTORY COURSES

1f,w,s-2w,s,su. GENERAL ZOOLOGY. A survey of the animal kingdom, emphasizing the principles of development and structure in relation to functions and habit, heredity and evolution, and the animals of economic importance. Lectures, quizzes and laboratory. NACHTRIEB, SIGERFOOS, LUND, ALLEN, RINGOEN.

9f,s-10w. HISTOLOGY AND EMBRYOLOGY. A comparative microscopic study of the origin and structure of the tissues of vertebrates and invertebrates, and of the organs of mammals. Textbook, lectures, and laboratory. DOWNEY.

17f-18w. GENERAL PHYSIOLOGY. Physical and chemical properties of living protoplasm and cells. Various organisms are selected which show

the nature of physiological processes and introduce the student to quantitative experimental methods in biology. Laboratory, lectures, and reading. LUND.

- 23s. MORPHOGENESIS AND THE BEHAVIOR OF ORGANISMS. Physiology of development of the egg. Regeneration. Production of heat, light, and electricity in animals. Comparative physiology of the nervous system, sense organs, and reactions in lower animals. Laboratory, lectures, and reading. LUND.
- 27s. COMPARATIVE ANATOMY OF VERTEBRATES. Lectures, quizzes, and laboratory work. ———, ———.
- 35s. GENERAL EMBRYOLOGY. A survey of general embryology and the organogeny of the vertebrates. Conference, reference, and laboratory work. NACHTRIEB.
- 37s-38w. GENERAL ENTOMOLOGY. Elements of entomology leading up to discussion of the principles of taxonomy and their application to the classification of insects. OESTLUND.
- 43s. INTRODUCTORY ENTOMOLOGY. The structure, development, and classification of insects. An introductory course in entomology and preparatory for courses in economic entomology. OESTLUND.
- 44f,s. ANIMAL PARASITES AND PARASITISM. Lectures and laboratory work. A consideration of the origin and biological significance of parasitism, and the structure, life history, and economic relations of representative parasites. Methods of control and prevention will be emphasized. RILEY.
- 45w,su. RELATION OF INSECTS TO DISEASE. The causation and transmission of disease by insects and other arthropods. Life history, habits, and methods of control of hominoxious species. RILEY.
- 59s. GENERAL ECOLOGY. A general course covering the relationships of animals, animal societies and faunas to the inorganic and organic factors of the environment. The course consists of lectures, assigned reading, recitations, laboratory and field work. CHAPMAN.

#### ADVANCED COURSES

- 107s. PROTOZOOLOGY. Lectures, reference and laboratory work on the structure and life histories of Protozoa, with special reference to the relation of the Protozoa to diseases of animals. SIGERFOOS.
- 109f-110w. GENERAL PHYSIOLOGY. A thoro survey of fundamental physiological processes in organisms. Based on Bayliss's "*Principles of General Physiology*." Laboratory, lectures, and reading. LUND.
- 114w-115s. ORNITHOLOGY. Structure, classification, and habits of birds with special reference to the birds of Minnesota. Considerable time devoted to field study. Bird or field-glasses and handbook required. Laboratory, lectures, and quizzes. Class limited to ten. ROBERTS.



- 117f-118w-119s. **ECOLOGY OF INSECTS.** General principles of ecology with special reference to the insects of Minnesota. Lectures, laboratory, assigned reading, and field work. CHAPMAN.
- 124su. **ADVANCED ECOLOGY.** Similar to 117-118-119 with special field work. CHAPMAN.
- 125f-126w-127s. **ADVANCED ENTOMOLOGY.** Advanced work in the lines of morphology and classification of insects, with lectures on the history of entomology. OESTLUND.
- 130w. **BIOLOGY AND TAXONOMY OF THE APHIDIDAE.** Intensive study of the natural history, bibliography, and classification of the Aphididae. OESTLUND.
- 139s,su. **HISTOLOGY AND DEVELOPMENT OF INSECTS.** Lectures and laboratory work on the histology, embryonic and postembryonic development of insects. RILEY.
- 182w. **GENETICS AND EUGENICS.** Facts and theories of heredity and the application of the laws governing natural inheritances for the improvement of the race. Lectures, references, quizzes, and demonstrations. (Not offered in 1919-20.) ———.

## ANIMAL HUSBANDRY

### ANIMAL INDUSTRY GROUP

Professors CARL W. GAY, WALTER H. PETERS, HENRY W. VAUGHAN; Assistant Professor PHILLIP A. ANDERSON; Instructors ARTHUR L. ANDERSON, NORRIS K. CARNES.

### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f,w.	Types and Breeds of Livestock...	5	All	None
2f.	Livestock Judging.....	3	Soph., jr., sr.	1
3f-4w.	Market Classes of Livestock....	6	Soph., jr., sr.	2
5w.	Livestock Breeding.....	3	Sr.	Vet. Med. 6, Agron. 131
6w.	Livestock Feeding.....	5	Sr.	Agr. Biochem. 15
7f.	Meats.....	3	Sr.	3, Agr. Biochem. 15
8s.	Elements of Feeding.....	3	Jr., sr.	None
9s.	Pedigrees and Herd Books.....	3	Sr.	5
<i>Advanced Courses</i>				
101f.	Advanced Stock Judging.....	3	Sr.	3-4
102s.	Horse Husbandry.....	3	Sr.	3-4, 5, 6
103s.	Beef Cattle Husbandry.....	3	Sr.	3-4, 5, 6
104s.	Sheep Husbandry.....	3	Sr.	3-4, 5, 6
105s.	Swine Husbandry.....	3	Sr.	3-4, 5, 6,
106w.	Advanced Meats.....	3	Sr.	7
107s.	Meat Problems.....	3	Sr.	106
108s.	Seminar.....	3	Sr.	5, 6

## INTRODUCTORY COURSES

- 1f,w. TYPES AND BREEDS OF LIVESTOCK. The types as related to performance or production in horses, beef cattle, sheep, and swine, and the origin, history, characteristics, and economic importance of the breeds, classified according to type. GAY, CARNES.
- 2f. LIVESTOCK JUDGING. Practice in judging horses, cattle, sheep, and hogs from both the type and the breed standpoint. A. L. ANDERSON.
- 3f-4w. MARKET CLASSES OF LIVESTOCK. Livestock markets and marketing methods. The market classes of horses, cattle, sheep, and swine. Practice in classifying, judging, and appraising livestock. VAUGHAN.
- 5w. LIVESTOCK BREEDING. The application of the principles of genetics to the breeding of livestock; a review of the master-breeders' methods and consideration of the practical breeders' problems. GAY.
- 6w. LIVESTOCK FEEDING. Feeding livestock under farm conditions; efficiency and economy in growing and fattening meat animals; feeding draft horses and colts. Consideration of experimental work and present practice. Practical feeding problems. Only three credits allowed to those who have completed Course 8. PETERS.
- 7f. MEATS. General course in the dressing of animals and the cutting of carcasses. Lectures and laboratory work. P. A. ANDERSON.
- 8s. ELEMENTS OF FEEDING. A general course giving a brief survey of livestock and dairy feeding designed for those students not specializing in either animal or dairy husbandry. Not open to those who have completed Course 6 or Dy. Husb. 103. PETERS, CORT.
- 9s. PEDIGREES AND HERD BOOKS. Pedigree registration; laboratory practice in the use of the stud, herd, and flock records; tracing and tabulating pedigrees. VAUGHAN.

## ADVANCED COURSES

- 101f. ADVANCED STOCK JUDGING. Competitive judging of all types, breeds, and classes of livestock supplemented by visits to nearby stock farms. PETERS.
- 102s. HORSE HUSBANDRY. Stud-farm management; the selection of foundation stock and the breeding, feeding, and marketing of horses. Horse-power; factors determining a horse's efficiency for work. GAY.
- 103s. BEEF CATTLE HUSBANDRY. The management of pure blood and grade herds; selection of foundation stock, sales, and shows, building, equipment, labor. Practicums in fitting cattle for show and sale, animal photography, preparation of feeds, and the care of cattle. PETERS.
- 104s. SHEEP HUSBANDRY. The care and management of pure-bred sheep, Study of pedigrees, registrations, fitting for show purposes, market-

ing. Practicums in feeding, shearing, blocking, and caring for young lambs. P. A. ANDERSON.

- 105s. SWINE HUSBANDRY. Cost of producing pork; equipment; swine types; pure-bred versus market hogs; building a breeding herd; feeding; marketing breeding stock; herd management; pedigree studies; fitting and showing. Barn work and feeding practice. VAUGHAN.
- 106w. ADVANCED MEATS. Practice work in dressing animals and cutting carcasses giving particular attention to conformation as related to dressing percentage and the carcass; also a study of the physical and chemical composition of meat. P. A. ANDERSON.
- 107s. MEAT PROBLEMS. The wholesale cuts and grades of meat; the packing industry and the utilization of by-products. Special problems and trips to packing establishments. P. A. ANDERSON.
- 108s. SEMINAR. Special problems and review of investigations pertaining to the livestock industry. GAY.

## BACTERIOLOGY AND IMMUNOLOGY

### MEDICAL SCHOOL

Professor WINFORD P. LARSON; Instructor ANNE G. BENTON; Assistants ROBERT G. GREEN, SIEGFRIED F. HERRMANN.

### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Course</i>				
6f,w,s.	Elementary Bacteriology.....	4	Soph., jr., sr.	None

For additional courses see the bulletin of the Medical School.

### INTRODUCTORY COURSE

6f,w,s. ELEMENTARY BACTERIOLOGY. Lecture and laboratory course. The principles and technique of general bacteriology. Studies in the morphologic and biologic characters of the common bacteria. Preparation of culture media. Disinfectants and disinfection. Bacteriology of water and food products. LARSON, BENTON, GREEN, HERRMANN.

## BEE CULTURE

Professor FRANCIS JAGER; Instructor LLOYD V. FRANCE.

*General statement.*—Theoretical and practical instruction on bees, honey, and wax production. At least one year of botany should be completed before electing these courses. General zoology and economic entomology are also desirable. If not already completed they should be taken at same time as the courses in bee culture.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1s,su.	Elements of Beekeeping I.....	3	Jr., sr.	None
2f,w.	Elements of Beekeeping II.....	3	Jr., sr.	None
3w-4s.	Advanced Beekeeping.....	6	Jr., sr.	1 or 2
5su.	Queen Raising.....	3	Jr., sr.	1 or 2

## INTRODUCTORY COURSES

- 1s,su. ELEMENTS OF BEEKEEPING I. Fundamentals of bee behavior during the honey season. Modern equipment for beekeeping practice. Fundamentals of beekeeping practice during the honey season. Production of comb and extracted honey. JAGER.
- 2f,w. ELEMENTS OF BEEKEEPING II. Fundamentals of bee behavior outside of the active season. Fundamentals of beekeeping practice outside of active season. Indoor and outdoor wintering. JAGER.
- 3w-4s. ADVANCED BEEKEEPING. Bee anatomy, bee botany, bee geography in their relations to commercial honey production. JAGER.
- 5su. QUEEN RAISING. Selecting queens, principles of reproduction, grafting, drone raising, mating. Nuclei, mailing, introducing. Bee diseases. In connection with Zumbra Heights queen bee raising station. JAGER.

## BOTANY

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors C. OTTO ROSENDAHL, ELIAS J. DURAND, LEE I. KNIGHT, JOSEPHINE E. TILDEN; Assistant Professors FREDERIC K. BUTTERS, WILLIAM S. COOPER, NED L. HUFF.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f,s-2w,f.	General Botany.....	10 <sup>1</sup>	All	None
7s.	Taxonomy of Flowering Plants.....	5	All	2
11f.	Algae and Fungi.....	5	Soph., jr., sr.	2
12w.	Bryophytes and Pteridophytes.....	5	Soph., jr., sr.	2
13s.	Angiosperms and Gymnosperms.....	5	Soph., jr., sr.	7 or 12
17w.	Anatomy of Vascular Plants.....	5	Soph., jr., sr.	2
51f.	Histological Methods.....	3	Jr., sr.	15 cred.
52f.	Plant Physiology.....	5	Jr., sr.	15 cred.
53w.	Botany of Economic Plants.....	5	Jr., sr.	15 cred.
54s.	Elementary Ecology.....	5	Jr., sr.	52

*Advanced Courses*

101f-102w-				
103s.	Fungi.....	9	Jr., sr.	7, 11
105s.	Algae.....	5	Jr., sr.	11
107w.	Bryophytes.....	5	Jr., sr.	7, 12
108s.	Pteridophytes.....	5	Jr., sr.	7, 12

<sup>1</sup> Course 2 must be completed before credit is allowed.

No.	Credits	Title	Offered to	Prereq. courses
110s.		Gymnosperms.....	5 Jr., sr.	7, 13
113f-114w-				
115s.		Advanced Taxonomy.....	9 Jr., sr.	7
118w-119s.		Cytology.....	6 Jr., sr.	51
131f.		Field Ecology.....	5 Sr.	54
133s.		Forest Geography of North America..	5 Sr.	54, 131 advised
141f.		Advanced Plant Physiology I.....	5 Sr.	52, Org. Chem.
142w.		Advanced Plant Physiology II.....	5 Sr.	52, Org. Chem.
143s.		Advanced Plant Physiology III.....	5 Sr.	52, Org. Chem.

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

#### INTRODUCTORY COURSES

- 1f,s-2w,f. GENERAL BOTANY.<sup>1</sup> Fundamental principles of botany. Survey of organs of the flowering plant; its internal structure and physiology. Representatives of the algae, fungi, liverworts, etc., examined with special reference to tracing evolution of the vegetable kingdom. DURAND, BUTTERS, HUFF and Assistants.
- 7s. TAXONOMY OF FLOWERING PLANTS. A general study of the classification and relationships of flowering plants. Laboratory and field practice in the determination of species, together with lectures and quizzes. ROSENDAHL.
- 11f. GENERAL MORPHOLOGY OF ALGAE AND FUNGI. A general survey of the structure, evolution, and classification of the algae and fungi. Lecture, laboratory, and field work. TILDEN.
- 12w. GENERAL MORPHOLOGY OF BRYOPHYTES AND PTERIDOPHYTES. A general survey of the structure, evolution, and classification of the liverworts, mosses, and ferns. HUFF.
- 13s. GENERAL MORPHOLOGY OF ANGIOSPERMS AND GYMNASPERMS. A general survey of the structure, evolution, and classification of seed plants. BUTTERS.
- 17w. ANATOMY OF VASCULAR PLANTS. A study of the microscopic structure of vascular plants, the cell, tissues and tissue systems with particular attention to the development and evolution of the vascular system in the root, stem, and leaf. BUTTERS.
- 51f. HISTOLOGICAL METHODS. Training in methods used in the preparation and preservation of class material. Special attention is given to methods of killing, imbedding, sectioning, staining, and mounting. DURAND.

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<sup>1</sup> Students entering college with a year of high-school botany satisfactory to the Department may be admitted directly to Course 2. All such must present to the Department before registration, their high-school note-book and a statement from their teacher showing the amount and proficiency of their work.



- 52f. PLANT PHYSIOLOGY. An introductory course giving a general survey of plant functions. KNIGHT.
- 53w. BOTANY OF ECONOMIC PLANTS. A survey course treating the most important botanical features of the common plants. KNIGHT.
- 54s. ELEMENTARY ECOLOGY. An introduction to the study of plants and their environment; investigation of the habitat; its effects upon plants as individuals and in mass; plant communities; plant successions. Laboratory and field work, lectures, and discussion. COOPER.

## ADVANCED COURSES

- 101f-102w-103s. FUNGI. A general course in the morphology and classification of the fungi. Fall quarter: Phycomycetes. Winter quarter: Ascomycetes. Spring quarter: Basidiomycetes. DURAND.
- 105s. ALGAE. A study of freshwater forms, based on collections made by the class. Lectures, laboratory, and field work. TILDEN.
- 107w. MORPHOLOGY AND TAXONOMY OF THE BRYOPHYTES. A special study of the structure and classification of the liverworts and mosses. (Not offered in 1919-20.) DURAND.
- 108s. MORPHOLOGY AND TAXONOMY OF THE PTERIDOPHYTES. An intensive study of lycopods, ferns, and their allies, their structure and history, with special attention to the classification of living forms. Lectures, reference reading, and laboratory work. (Not offered in 1919-20.) BUTTERS.
- 110s. MORPHOLOGY AND TAXONOMY OF THE GYMNOSPERMS. An intensive study of cycads, conifers, and their allies, their structure and history, with special attention to the classification of living forms. Lectures, reference reading, and laboratory work. BUTTERS.
- 113f-114w-115s. ADVANCED TAXONOMY. An advanced course in which special attention is given to the taxonomy of difficult natural groups, involving systematic principles and practice, rules of nomenclature, systems of classification, etc. ROSENDAHL.
- 118w-119s. CYTOLOGY. A survey of cell structure and the various phenomena of division, fusion, and metamorphosis, together with a review of the history of cytological investigation. Methods of cytological research indicated in the laboratory. ROSENDAHL.
- 131f. FIELD ECOLOGY. A careful study of the local plant communities and successions, followed by a written report, and by a study of the general principles of plant association and succession. COOPER.
- 133s. FOREST GEOGRAPHY OF NORTH AMERICA. Preliminary discussion of principles of plant distribution, followed by detailed study of the forest regions of North America; reading, discussion, lantern slides, distribution maps, microscopic work, written reports. COOPER.

- 141f. ADVANCED PLANT PHYSIOLOGY I. Physical phases of plant physiology. A course dealing with the intake of materials and their translocation, also the energy relations of the plant. KNIGHT.
- 142w. ADVANCED PLANT PHYSIOLOGY II. Plant metabolism. A course dealing with the synthesis of plant food, its transformation and utilization by the plant. KNIGHT.
- 143s. ADVANCED PLANT PHYSIOLOGY III. Plant metabolism and growth. Continuation of 142, also introducing certain fundamental phases of growth. KNIGHT.

## CHEMISTRY

### THE SCHOOL OF CHEMISTRY

Professors LAUDER W. JONES, CHARLES F. SIDENER; Associate Professors  
WILLIAM H. HUNTER, FRANK H. MACDOUGALL; Assistant Professors  
ISAAC W. GEIGER, FRANK C. WHITMORE; Instructor GUY H. WOOLLETT.

#### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f-2w-3s.	General Inorganic Chemistry.....	12	All	None
9f-10w.	Advanced General Inorganic Chemistry.....	10	All	H.-S. chem.
11s.	Qualitative Chemical Analysis.....	4	Soph., jr., sr.	1-2-3
12s-13f.	Qualitative Chemical Analysis.....	10	Soph., jr., sr.	9-10
20w.	Quantitative Analysis.....	5	Soph., jr., sr.	11 or 12-13
21s.	Quantitative Analysis.....	5	Soph., jr., sr.	20
35f-36w.	Organic Chemistry.....	10	Soph., jr., sr.	1-2-3 or 9-10
<i>Advanced Courses</i>				
126s.	Sanitary Water Analysis.....	1 or 2	Sr.	21
141f-142w-				
143s.	Physical Chemistry.....	9, 12, or 15	Jr., sr.	30 cred., Phys. 15 cred.

For additional courses see the bulletin of the School of Chemistry.

#### INTRODUCTORY COURSES

- 1f-2w-3s. GENERAL INORGANIC CHEMISTRY. Designed for those who have had no high-school chemistry. 1-2—A study of the general laws of chemistry and of the non-metals and their compounds. 3—Metals and their compounds. WHITMORE.
- 9f-10w. ADVANCED GENERAL INORGANIC CHEMISTRY. Designed for those who have had one year of high-school chemistry. 9—General laws of chemistry, the non-metals and their compounds. 10—Metals and their compounds and ionic equilibrium, considered quantitatively.
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- 11s. QUALITATIVE CHEMICAL ANALYSIS. Laboratory work in systematic qualitative analysis with lectures on solution, ionization, chemical and

physical equilibrium, oxidation and reduction, and other subjects pertinent to qualitative analysis. —————.

- 12s-13f. **QUALITATIVE CHEMICAL ANALYSIS.** Laboratory work in systematic qualitative analysis with lectures on solution, ionization, chemical and physical equilibrium, oxidation and reduction, and other subjects pertinent to qualitative analysis. WHITMORE.
- 20w. **QUANTITATIVE ANALYSIS.** An introductory course covering the general principles and methods of quantitative analysis, both gravimetric and volumetric. Typical problems will be assigned and attention given to proper laboratory practice. SIDENER, GEIGER.
- 21s. **QUANTITATIVE ANALYSIS.** Supplementary to Course 20. Further discussion of the principles and methods together with laboratory work on additional typical problems in gravimetric and volumetric analysis. SIDENER, GEIGER.
- 35f-36w. **ORGANIC CHEMISTRY.** An introduction to the chemistry of carbon compounds. The laboratory work will include the preparation of characteristic substances. HUNTER, WOOLLETT.

#### ADVANCED COURSES

- 126s. **SANITARY WATER ANALYSIS.** Lectures and laboratory practice in the chemical examination of potable waters. SIDENER, GEIGER.
- 141f-142w-143s. **PHYSICAL CHEMISTRY.** A general survey of the subject. Three lectures and one recitation. Laboratory work three or six hours per week. Nine, twelve, or fifteen credits, depending on amount of laboratory work. MACDOUGALL.

### DAIRY HUSBANDRY

#### ANIMAL INDUSTRY GROUP

Professors CLARENCE H. ECKLES, ROBERT M. WASHBURN; Professor Emeritus THEOPHILUS L. HAECKER; Assistant Professors JOSEPH C. CORT, EDWIN O. HANSON; Instructor LESLIE V. WILSON; Extension Specialists ARTHUR J. MCGUIRE, WILLIAM A. MCKERROW, ALLAN B. RAYBURN.

#### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f.s.	Elements of Dairying.....	5	All	None
2w.	Dairy Bacteriology.....	3	Soph., jr., sr.	Bact. 6
3f.	Factory Management.....	5	Jr., sr.	1, 2
4su.	Cheese Factory Practice.....	3	Jr., sr.	1, 3
5su.	Creamery Practice.....	3	Jr., sr.	1, 3
<i>Advanced Courses</i>				
101f.	Milk Production.....	5	Jr., sr.	1
102s.	Market Milk.....	3	Jr., sr.	1, 2

No.	Title	Credits	Offered to	Prereq. courses
103w.	Dairy Stock Feeding.....	3	Sr.	101 Agr. Biochem. 15
104s.	Advanced Study of Dairy Breeds	3	Jr., sr.	1, 101
105f.	Seminar I.....	1	Sr.	3 courses in Dy. Husb
106w.	Seminar II.....	1	Sr.	3 courses in Dy. Husb.
107s.	Seminar III.....	1	Sr.	3 courses in Dy. Husb.

## INTRODUCTORY COURSES

- 1f.s. ELEMENTS OF DAIRYING. Composition of milk. Causes of variation in composition; milk constituents and their uses in dairy manufactures and as food; Babcock test; sanitary handling of milk and cream on the farm; cream separating and farm buttermaking. WASHBURN, CORT, HANSON, WILSON.
- 2w. DAIRY BACTERIOLOGY. Lectures and demonstrations. Types of milk organisms; the contamination of milk and how prevented; relation of milk to the public health; the bacteriology of buttermaking and cheesemaking. \_\_\_\_\_
- 3f. FACTORY MANAGEMENT. History and organization of dairy associations. Location, construction and equipment of butter, cheese, condensed milk, and ice cream factories; lectures and practice work in creamery buttermaking and scoring; creamery accounting. WASHBURN.
- 4su. CHEESE FACTORY PRACTICE. A minimum of one month's experience in an approved practical cheese factory. Records are kept and reports made. WASHBURN.
- 5su. CREAMERY PRACTICE. A minimum of one month's experience in an approved practical creamery. Records are kept and a report made. WASHBURN.

## ADVANCED COURSES

- 101f. MILK PRODUCTION. Problems of the dairy farmer, such as characteristics and adaptations of the dairy breeds; selection and management of the dairy herd and sire; calf raising; dairy barns. Laboratory: comparative judging and study of breed type. ECKLES, CORT, WILSON.
- 102s. MARKET MILK. Lectures and laboratory work. Classes of market milk; transportation and marketing; sanitary inspection; equipment of plants; problems of public control. WASHBURN.
- 103w. DAIRY STOCK FEEDING. Application of principles of nutrition to feeding the dairy cow and growing young animals. Feeding standards; characteristics of various feeding stuffs; formulation of rations. Only two credits allowed those who have completed An. Husb. 8. ECKLES, CORT, WILSON.

- 104s. ADVANCED STUDY OF DAIRY BREEDS. Practice in comparative judging of dairy cattle representing different breeds and ages; selection and valuation of cattle according to type and pedigree; a study of important strains and families; visits to pure-bred herds. CORT, WILSON.
- 105f. SEMINAR I. Special investigation and study of selected topics. Each student presents papers and reports on assigned subjects and reviews recent scientific investigations along dairy husbandry lines. ECKLES, WASHBURN.
- 106w. SEMINAR II. Continuation of 105, but 105 not a prerequisite. ECKLES, WASHBURN.
- 107s. SEMINAR III. Continuation of 106, but 106 not a prerequisite. ECKLES, WASHBURN.

## DRAINAGE

## AGRICULTURAL ENGINEERING GROUP

Professor JOHN T. STEWART.

## COURSES

*Introductory Course*

1. Farm Drainage..... 3 Jr., sr. F. Eng. 18

For additional courses see later announcement in fall quarter program.

## INTRODUCTORY COURSE

1. FARM DRAINAGE. Principles and practice of farm drainage. Field technique of drainage construction by hand and machine. This course is for students wishing to do special work in drainage. ———.

## ECONOMICS

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors WILLARD E. HOTCHKISS, GEORGE W. DOWRIE, N. S. BRIEN GRAS; Associate Professors ROY G. BLAKEY, WILLIAM W. CUMBERLAND, ALVIN H. HANSEN, BRUCE D. MUDGETT; Assistant Professors JOHN D. BLACK, Z. CLARKE DICKINSON, CLARENCE L. HOLMES, THOMAS S. SANDERS; Professorial Lecturers J. FRANKLIN EBERSOLE, JOHN H. SHERMAN; Instructors VICTOR H. PELZ, J. WARREN STEHMAN.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f-2w.	Introduction to Economic History...	10	All	None
3f-4w.	Principles of Economics.....	10	Soph., jr., sr.	None
5f,s. <sup>1</sup>	General Economics.....	5	All <sup>2</sup>	None
6w <sup>1</sup>	Agricultural Economics.....	3	Soph., jr., sr.	5

<sup>1</sup> Given at the University Farm.

<sup>2</sup> Not offered to first and second quarter freshmen.



No.	Title	Credits	Offered to	Prereq. courses
11f-12w.	Statistics.....	6 <sup>2</sup>	Soph., jr., sr.	3-4, or 5, 6
18s. <sup>1</sup>	Problems in Agricultural Economics..	5	Soph., jr., sr.	3-4, or 5, 6
19f. <sup>1</sup>	Principles of Agricultural Marketing..	5	Jr., sr.	3-4, or 5, 6
20w.	Problems in Rural Economics.....	5	Soph., jr., sr.	3-4, or 5, 6
23s.	Business Organization and Manage- ment.....	5	Soph., jr., sr.	3-4, or 5, 6
25f-26w.	Principles of Accounting.....	6 <sup>2</sup>	Soph., jr., sr.	None
41s.	Financial History of the United States	3	Jr., sr.	3-4, or 5, 6
150s. <sup>1</sup>	Farm Finance.....	3	Jr., sr.	3-4, or 5, 6
54f.	Corporation Finance.....	3	Jr., sr.	3-4, or 5, 6
55w.	Advanced Corporation Finance.....	3	Jr., sr.	54
85f.	Principles of Marketing.....	5	Jr., sr.	3-4, or 5, 6
88w.	Retail Marketing.....	3	Jr., sr.	85
<i>Advanced Courses</i>				
107f.	Land Tenure.....	5	Jr., sr.	3-4, or 5, 6
108w. <sup>1</sup>	Agricultural Statistics.....	5	Jr., sr.	11
109s. <sup>1</sup>	Economics of Consumption.....	5	Jr., sr.	3-4, or 5, 6
110w. <sup>1</sup>	Farm Marketing Problems.....	5	Jr., sr.	19
116f-117w-				
118s. <sup>1</sup>	Advanced Agricultural Economics...	9	Sr.	15 cr.
119f-120w-				
121s. <sup>1</sup>	Seminar in Agricultural Economics...	9	Sr.	20 cr.
126f-127w-				
128s. <sup>1</sup>	Special Research Problems in Agricul- tural Economics.....	9	Sr.	15 cr.
143f-144w.	Money and Banking .....	10	Jr., sr.	3-4, or 5, 6
161f.	Labor Problems.....	3	Jr., sr.	3-4, or 5, 6
191f-192w.	Public Finance.....	6	Jr., sr.	3-4, or 5, 6, or Pol. Sci. 13 cr.
193s.	State and Local Taxation.....	3	Jr., sr.	191-192

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

<sup>1</sup> Given at the University Farm.

<sup>2</sup> Students in the College of Agriculture, Forestry and Home Economics may receive credit at end of first quarter.

#### INTRODUCTORY COURSES

1f-2w. INTRODUCTION TO ECONOMIC HISTORY WITH SPECIAL EMPHASIS ON THE UNITED STATES. Lectures and section work. A general survey of the development of agriculture, manufacture, transportation, storage, and the exchange of goods; economic crises; land, capital, management, and labor; the interplay of economic and political forces. GRAS, DICKINSON.

3f-4w. PRINCIPLES OF ECONOMICS. Principles that underlie the present industrial order. Application of principles to economic problems such as labor, insurance, finance, transportation, industrial combination, government control. HANSEN.

5s,f. GENERAL ECONOMICS. Principles of economics combined with the necessary descriptive facts, as relating to economic life in general and to agriculture and forestry in particular. HOLMES.

- 6w. AGRICULTURAL ECONOMICS. Principles of agricultural economics with special emphasis upon production. HOLMES.
- 11f-12w. STATISTICS. Principles of collection, tabulation, and interpretation of statistical material, illustrated by present-day statistical data. Lectures, assigned readings and special investigations by individual members of the class. MUDGETT.
- 18s. PROBLEMS IN AGRICULTURAL ECONOMICS. Practice in the economic analysis of a number of problems confronting the farmer as producer and consumer. BLACK.
- 19f. PRINCIPLES OF AGRICULTURAL MARKETING. The organization and methods of marketing; the function of middleman; the costs of marketing various farm products; coöperative marketing. ———.
- 20w. PROBLEMS IN RURAL ECONOMICS. A survey of the economic aspects of the important problems of rural life, such as rural population, rural migration, tenancy, agricultural labor, marketing of farm products, coöperation, rural credit, land settlement. CUMBERLAND.
- 23s. BUSINESS ORGANIZATION AND MANAGEMENT. Organization, principles applying to business in general and to particular concerns; evolution, objects, adjustments, limits, functional division; specialization—functional and other forms; standardization. Management, coördination of functions, handling of men, employment, external versus internal factors. HOTCHKISS, PELZ.
- 25f-26w. PRINCIPLES OF ACCOUNTING. The purpose and principles of account classification; capital and revenue; accruals; valuation; depreciation; preparation and interpretation of balance sheets, income accounts and other statements; corporation accounts. A laboratory course with supplementary lectures. SANDERS.
- 41s. FINANCIAL HISTORY OF THE UNITED STATES. American financial legislation from colonial times with especial emphasis upon the distinction between maintaining a standard of value and the providing of a revenue for the needs of government. BLAKEY.
- 54f. CORPORATION FINANCE. The organizing, financing, and managing of corporations. A study of corporate securities for purposes of promotion and reorganization and of facilities for marketing them. STEHMAN.
- 55w. ADVANCED CORPORATION FINANCE. A study of the financial history of certain typical corporations with special reference to their promotion and reorganization. STEHMAN.
- 85f. PRINCIPLES OF MARKETING. Domestic merchandising methods of manufacturers. Problems of wholesalers and commission men; distributing system and market organization; price policies. SHERMAN.

- 88w. RETAIL MARKETING. Problems and methods of the so-called regular retailer, department stores, and chain stores. Development of retail trade centers. Coöperation between the retailer and the local board of trade. The retailer and the consumer. PELZ.

## ADVANCED COURSES

- 107f. LAND TENURE. Problems arising out of the land basis of civilization: property in land; land utilization; rents and land values; land taxation; urban and rural housing and planning; land classification and settlement; farm labor; tenancy, ownership. BLACK.
- 108w. AGRICULTURAL STATISTICS. Study and practice of the special methods of statistical investigation, analysis and presentation which have been developed for agriculture, together with descriptive statistics of agriculture. BLACK.
- 109s. ECONOMICS OF CONSUMPTION. Nature of human wants; standards of living; cost of living; income; administration of income; nature of demand; demand and price; relation of consumption to production; consumption and the population problem.
- 110w. FARM MARKETING PROBLEMS. Studies in the methods of private and coöperative marketing of selected farm products.
- 116f-117w-118s. ADVANCED AGRICULTURAL ECONOMICS. Economic theory of production, consumption, exchange, and value and distribution applied to agriculture. CUMBERLAND, BLACK, HOLMES.
- 119f-120w-121s. SEMINAR IN AGRICULTURAL ECONOMICS. Subjects for group study selected from the following: competition of types of farming; markets and transportation of farm products; farmers' coöperation; prices of farm products; rural credit; land valuation; land settlement; land taxation. CUMBERLAND, BLACK, HOLMES.
- 126f-127w-128s. SPECIAL RESEARCH PROBLEMS IN AGRICULTURAL ECONOMICS. Intensive individual research work on problems not being studied in the seminar during the quarter. CUMBERLAND, BLACK, HOLMES.
- 143f-144w. MONEY AND BANKING. Relation to industrial system. Monetary principles with special reference to United States. American banking and bank organization, principles of commercial banking, non-commercial banking, relation of government to banking, comparative study of leading foreign systems. DOWRIE, EBERSOLE, STEHMAN.
- 150s. FARM FINANCE. The financial needs of typical farmers. Present facilities for supplying them—institutions, their organization and operation, interest rates, defects and proposed remedies. The financing of the various farmers' organizations. The farmer as an investor. DOWRIE.

- 161f. LABOR PROBLEMS. Modern labor problems; woman and child labor, industrial hygiene, welfare work, profit-sharing, coöperation, labor unions, strikes, boycotts, conciliation, and arbitration; economic causes and effects of immigration. ———.
- 191f-192w. PUBLIC FINANCE. Public expenditures; public debt; budgetary legislation; tax systems. BLAKEY.
- 193s. STATE AND LOCAL TAXATION. Problems of state and local taxation. Historic survey of various taxes and examination of present procedure in taxing different kinds of property; tax reforms. Particular attention given to conditions in Minnesota. BLAKEY.

## EDUCATION

## COLLEGE OF EDUCATION

Professors LOTUS D. COFFMAN, FLETCHER H. SWIFT; Assistant Professors HERMIONE L. DEALEY, MARVIN J. VAN WAGENEN; Instructors JEAN H. ALEXANDER, FRANCES MOREHOUSE.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f,w-2w,s.	Brief Course in the History of Education.....	6	Jr., sr.	Psychol. 1-2-3
5w. <sup>1</sup>	The American School.....	3	Jr., sr.	Psychol. 1-2
11f,w,s.	Technique of Teaching.....	3	Jr., sr.	Psychol. 1-2-3
55f,w,s.	Elementary Educational Psychology..	3	Jr., sr.	Psychol. 9 cred.
<i>Advanced Courses</i>				
101f-102w- 103s.	Historical Foundations of Modern Education.....	9	Jr., sr.	Psychol. 1-2-3, Hist. 6 cred.
106f-107w- 108s.	Advanced Educational Psychology...	9	Sr.	Psychol. 1-2-3
109f,s.	Educational Diagnosis.....	2	Sr.	1 or 101-102-103

For additional courses see the bulletin of the College of Education.

<sup>1</sup> Given at the University Farm.

## INTRODUCTORY COURSES

- 1f,w-2w,s. A BRIEF COURSE IN THE HISTORY OF EDUCATION. Current school problems and educational theories in the light of their history. Emphasis upon secondary education and those aspects of education of most immediate concern to high-school teachers. Not open to those who have credit in Course 5. ALEXANDER.
- 5w. THE AMERICAN SCHOOL. A brief survey of the factors determining the problem of public education in America, followed by a brief account of the development and organization of typical state school systems. Not open to those who have credit in Course 1. SWIFT.

11f,w,s. **TECHNIQUE OF TEACHING.** Types of classroom exercises; preparation of teaching plans; hygiene of instruction; classroom management; the professional ethics of teaching; observation of high-school work. MOREHOUSE.

55f,w,s. **ELEMENTARY EDUCATIONAL PSYCHOLOGY.** Brief scientific study of individual behavior from standpoint of learning process. Certain topics receive special emphasis, e.g., economy of time and energy in learning, instinctive and emotional reactions, habit formation, methods of learning, fatigue. DEALEY.

#### ADVANCED COURSES

101f-102w-103s. **FOUNDATIONS OF MODERN EDUCATION.** Interpretative historical study of elements in modern education derived from Hebrews, Greeks, Romans, Middle Ages, Renaissance. Emphasis upon secondary and higher education, origin and results of monopoly of cultural conception of education and cultural studies. SWIFT.

106f-107w-108s. **EDUCATIONAL PSYCHOLOGY.** Psychology of learning. Methods of measuring rate of learning; study of typical learning experiments and examination of the conditions of the most economic learning, study of individual differences, and psychology of the school subjects. VAN WAGENEN.

109f,s. **EDUCATIONAL DIAGNOSIS.** A study of educational scales and standard tests for measurement of efficiency in school subjects. The course will deal with the nature of the tests, methods of their use, and an analysis of results obtained. VAN WAGENEN.

#### ENTOMOLOGY AND ECONOMIC ZOOLOGY

Professors WILLIAM A. RILEY, FREDERIC L. WASHBURN; Associate Professors WILLIAM MOORE, ARTHUR G. RUGGLES; Assistant Professors ROYAL N. CHAPMAN, OSCAR W. OESTLUND; Assistants SAMUEL A. GRAHAM, ANNA WENTZ.

*General statement.*—For specialization in this department see Course of Study. Courses in this Department are closely correlated with those offered by the Department of Animal Biology of the College of Science, Literature, and the Arts. Courses 37-38-39, 44, 45, 116, 117-118-119, 125-126-127, 130, and 197 of this Division are also offered under these numbers by the Department of Animal Biology.

#### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f,s,su.	Introductory Entomology.....	5	Soph., jr., sr.	An. Biol. 10 cred.
2w,su.	Economic Entomology.....	5	Soph., jr., sr.	1
3f.	Elementary Economic Entomology..	3	Soph., jr., sr.	An. Biol. 10 cred.
4f.	Economic Vertebrate Zoology.....	3	Jr., sr.	An. Biol. 10 cred.



No.	Title	Credits	Offered to	Prerequisite courses
12w.	Forest Zoology.....	3	Jr., sr.	3
14w.	Insects and Public Health.....	3	Jr., sr.	An. Biol. 10 cred.
16s.	Plant Pest Control.....	3	Jr., sr.	1-2, or 3, Pl. Path. 1
37f-38w-				
39s.	General Entomology.....	9	Soph., jr., sr.	An. Biol. 10 cred.
44f,s.	Animal Parasites and Parasitism.....	3	Soph., jr., sr.	An. Biol. 10 cred.
45w,su.	Relation of Insects to Disease.....	3	Soph., jr., sr.	1 or equiv.

*Advanced Courses*

117f-118w-				
119s.	General Ecology of Insects.....	9	Jr., sr.	1-2 or 37-38-39
125f-126w-				
127s.	Advanced General Entomology.....	9	Jr., sr.	1-2 or 37-38-39
130w.	Biology and Taxonomy of the Aphid- idae.....	5	Sr.	1-2 or 37-38-39
139s,su.	Histology and Development of Insects	5	Jr., sr.	1-2 or 37-38-39
140f,su.	Insecticides and Their Action.....	3 or 6	Jr., sr.	1-2, or 37-38-39 Agr. Biochem., 7-8 or equiv.
197f,w,s, su.	Introduction to Research.....	5 or more	Sr.	1-2 or 37-38-39 and other work as prescribed by the Division

## INTRODUCTORY COURSES

- 1f,s,su. INTRODUCTORY ENTOMOLOGY. Lectures and laboratory work on the characteristics and habits of insects. OESTLUND, RILEY.
- 2w,su. ECONOMIC ENTOMOLOGY. The life histories, habits and methods of control of the insect pests of orchard, field, and garden. Laboratory work in the determination of the more important forms. RUGGLES.
- 3f. ELEMENTARY ECONOMIC ENTOMOLOGY. A brief course dealing with the characteristics and habits of insect pests and beneficial insects and methods of control. Not open to students planning to specialize in entomology. GRAHAM.
- 4f. ECONOMIC VERTEBRATE ZOOLOGY. Relation of birds and wild animals to agriculture. Lectures, laboratory, and field work. Identification and studies of Minnesota birds and wild animals affecting the horticulturist and agriculturist, methods of combating injuries and conserving useful forms. WASHBURN.
- 12w. FOREST ZOOLOGY. Forest Animals. Relation of birds and of various four-footed animals to forest protection. Habits, range, usefulness; the manner of protecting the important large and small game, fish, and birds; fish culture. WASHBURN.
- 14w. INSECTS AND PUBLIC HEALTH. The agency of insects and related forms in the transmission of disease; methods of sanitation related to their control and disease transmission. Not open for credit to students specializing in entomology. (See Courses 44, 45.) RILEY.

- 16s. PLANT PEST CONTROL. The theory and practice of control of insect and fungous pests of crop plants. Practical applications. Not open to those who have completed Pl. Path. 14. Same as Plant Pathology 6. RUGGLES, BISBY, STAKMAN.
- 37f-38w-39s. GENERAL ENTOMOLOGY. A more extended course than 1, leading up to discussion of the principles of taxonomy and their application to the classification of insects. Textbook, lectures, quizzes, and laboratory. OESTLUND.
- 44f,s. ANIMAL PARASITES AND PARASITISM. Lectures and laboratory work. A consideration of the origin and biological significance of parasitism, and of the structure, life history, and economic relations of representative animal parasites. Methods of control and prevention will be emphasized. RILEY.
- 45w,su. RELATION OF INSECTS TO DISEASE. The causation and transmission of disease by insects and other arthropods. Life histories, habits, and methods of control of hominnoxious species. RILEY.

## ADVANCED COURSES

- 117f-118w-119s. GENERAL ECOLOGY OF INSECTS. General ecology with special reference to the insects of Minnesota. Frequent field trips. Lectures, laboratory, and field work. CHAPMAN.
- 125f-126w-127s. ADVANCED GENERAL ENTOMOLOGY. Advanced work in the lines of morphology and classification of insects with lectures on the history of entomology. Lectures and laboratory. OESTLUND.
- 130w. BIOLOGY AND TAXONOMY OF THE APHIDIDAE. Intensive study of the natural history, bibliography, and classification of the aphididae. Additional work is offered in Course 197. OESTLUND.
- 139s,su. HISTOLOGY AND DEVELOPMENT OF INSECTS. Lectures and laboratory work on the histology, embryonic and postembryonic development of insects. Individual work along these lines is available to properly qualified students in Course 197. RILEY.
- 140f,su. INSECTICIDES AND THEIR ACTION. A study of the chemical composition, the physical properties, and the physiological action of standard, of little known, and of new insecticides. MOORE.
- 197f,w,s,su. INTRODUCTION TO RESEARCH. Preparation for investigational work in lines of entomology, parasitology, or economic zoology. Advanced laboratory, field and library work; training in the preparation of bibliographies and manuscripts; special problems. Summer work should be planned when possible. OESTLUND, Systematic Entomology; RUGGLES, General Economic Entomology; CHAPMAN, Insect Ecology; MOORE, Insecticides; RILEY, Parasitology; Insect Morphology; WASHBURN, Economic Vertebrate Zoology.

## FARM ENGINEERING

## AGRICULTURAL ENGINEERING GROUP

Professor WILLIAM BOSS; Assistant Professors HARRY B. ROE, HALL B. WHITE; Instructors J. GRANT DENT, RASMUS M. HALL, MAURICE G. JACOBSON, ALLEN D. JOHNSTON, JAMES B. TORRANCE.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
3f,s.	Mechanical Drawing.....	3	All	None
4w.	Blacksmithing.....	3	All	None
5f.	Carpentry.....	3	All	None
7w.	Farm Structures.....	3	Jr., sr.	3
10f.w.	Farm Engineering.....	3	All	None
11f.w.	Applied Mathematics.....	5	All	None
13f,s.	Farm Motors.....	3	All	None
15f,s.	Mechanics Laboratory.....	2	All	None
17f.	Advanced Blacksmithing.....	3	All	4
18s.	Surveying.....	5	Soph., jr., sr.	3, 11 or equiv.
21f-22w	Agricultural Physics.....	10	All	None
28w.	Land Clearing.....	3	Soph., jr., sr.	None

## INTRODUCTORY COURSES

- 3f,s. MECHANICAL DRAWING. Mechanics of drawing. Exercises in the use of drawing instruments, lettering, and water colors. The mechanics of working drawings with their practical value. JACOBSON.
- 4w. BLACKSMITHING. The management of forge and fire in bending, shaping and welding iron. JOHNSTON.
- 5f. CARPENTRY. The use of carpentry tools and methods of farm building construction. WHITE.
- 7w. FARM STRUCTURES. The planning, designing, and location of farm buildings including specifications and estimates of cost. WHITE.
- 10f,w. FARM ENGINEERING. A general course of farm engineering. Lectures on farm measurements, drainage, water supply, irrigation, sanitation, buildings, roads, power, machinery, and land clearing. BOSS.
- 11f,w. APPLIED MATHEMATICS. Rules of practical mathematics with special attention to formulas and problems directly related to agricultural work; e.g., areas, volumes, percentages, proportions, variations, investments, cost problems, etc. ROE.
- 13f,s. FARM MOTORS. Theory, operation, care, and repair of gasoline engines. TORRANCE.
- 15f,s. MECHANICS LABORATORY. Exercises in harness repair, knots and rope splicing, belt lacing, soldering, babbitting, pipe fitting, drilling, and work with cold metals. DENT.
- 17f. ADVANCED BLACKSMITHING. Bending, shaping, welding, and tempering of steel. JOHNSTON.

- 18s. SURVEYING. Plain surveying as applied to farm problems. Mensuration, leveling, simple grade determination, elements of topography, and farm mapping. ROE.
- 21f-22w. AGRICULTURAL PHYSICS. Mechanics of solids and fluids, sound and heat, light, electricity, and magnetism, and their application to farm problems. HALL.
- 28w. LAND CLEARING. A study of land clearing methods, explosives, and machinery. ....

## FORESTRY

Professor EDWARD G. CHEYNEY.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f,s.	General Forestry.....	4	All	None
21w.	Tree Crops.....	3	All	None

For additional courses see the bulletin of the Courses in Forestry.

## INTRODUCTORY COURSES

- 1f,s. GENERAL FORESTRY. A brief history of the development of forestry in Europe and America; description of the United States forests. Lectures and collateral reading. CHEYNEY.
- 21w. TREE CROPS. The part trees play in the successful development of the farm. The relation of the forests to agriculture and animal husbandry. The farm and the timber supply. CHEYNEY.

## GEOLOGY AND MINERALOGY

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors WILLIAM H. EMMONS, FRANK F. GROUT; Assistant Professors A. WALFRED JOHNSTON, CHESSLEY J. POSEY, TERENCE T. QUIRKE; Instructor THOMAS M. BRODERICK.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f,s-2w,su.	General Geology.....	10 <sup>1</sup>	Soph., jr., sr.	None
4w.	Geology of Minnesota.....	5	Soph., jr., sr.	1-2
5f-6w.	Economic Geology.....	6 <sup>1</sup>	Jr., sr.	1-2
7f,s-8w,su.	Laboratory Work.....	2 <sup>1</sup>	Soph., jr., sr.	Supports 1-2
21w-22s.	Elements of Mineralogy.....	10 <sup>1</sup>	Soph., jr., sr.	See statement
29f.	General Physiography.....	5	Soph., jr., sr.	None
34w.	Meteorology.....	3	Soph., jr., sr.	None
37s.	Economic and Commercial Geography	3	All	None

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

<sup>1</sup> Both quarters must be completed before credit will be given.

## INTRODUCTORY COURSES

- 1f,s-2w,su. GENERAL GEOLOGY. A synoptical treatment of materials of the earth and of geologic processes. Physiographic, dynamic, and structural geology, with a brief introduction to historical geology. Lectures, laboratory work, field excursions, map study, and conferences. EMMONS, JOHNSTON.
- 4w. GEOLOGY OF MINNESOTA. The physical geography and geologic history of Minnesota. The relations of industrial development to geological features. The principles of pre-Cambrian geology as exemplified in Minnesota. (Not offered in 1919-20.) JOHNSTON.
- 5f-6w. ECONOMIC GEOLOGY. The mineral resources of the United States. The origin, occurrence, distribution, and uses of the more important minerals and mineral fuels of economic value. Lectures, and field excursions. QUIRKE.
- 7f,s-8w,su. LABORATORY WORK. Open only to students taking Course 1-2. Supplements Course 1-2 with study of rocks and ores, topographic and geologic maps, and reference reading. JOHNSTON.
- 21w-22s. ELEMENTS OF MINERALOGY. Open to students taking Chemistry. The crystal systems; morphological, physical, and chemical character of minerals; occurrence, genesis, and uses of minerals; classification and description of common minerals. Determinative work in laboratory, blowpipe analysis, sight identification. GROUT, BRODERICK.
- 29f. GENERAL PHYSIOGRAPHY. Principles of earth sculpture; physiographic changes in progress, and agencies causing them; hydrography and oceanography; planetary relations; climatology; field excursions. POSEY.
- 34w. METEOROLOGY. The properties and phenomena of the atmosphere, including composition, temperature, pressure, and circulation; the work of the Weather Bureau; the major climatic divisions of the earth and their climates. ....
- 37s. ECONOMIC AND COMMERCIAL GEOGRAPHY. A study of the geographic factors influencing production and trade. Natural resources in their relation to commerce and industry and the major trade routes will be emphasized. POSEY.

## GERMAN

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professor CARL SCHLENKER; Assistant Professors OSCAR C. BURKHARD, JAMES DAVIES, ALFRED E. KOENIG, SAMUEL KROESCH, WALTER R. MYERS,



COURSES				
No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f,s.	Beginning.....	5	All	None
2f,w.	Beginning, Intermediate.....	5	All	1 or 1 yr. prep. German
3f,s.	Beginning, Advanced.....	5	All	2
10f,s.	Rapid Reading.....	5	All	3
11w,s.	Advanced Rapid Reading.....	5	All	10
12f,s.	Narrative Prose.....	5	All	2 yrs. prep. Ger- man
13f,w.	Advanced Narrative Prose.....	5	All	12
14w,s.	Prose and Poetry.....	5	All	13
28f,w-29w,s.	Advanced Chemical German.....	6 <sup>1</sup>	All	15
31f,w-32w,s.	Medical German.....	6 <sup>1</sup>	All	10 or 12
50f-51w-52s.	Composition.....	3 <sup>1</sup>	Soph., jr., sr.	11 or 14 <sup>2</sup>
53f-54w-55s.	Conversation.....	3 <sup>1</sup>	Soph., jr., sr.	11 or 14 <sup>2</sup>
62f,s.	German Comedies.....	3	Soph., jr., sr.	11 or 14 <sup>2</sup>
63w.	Modern Drama.....	3	Soph., jr., sr.	11 or 14 <sup>2</sup>
64s.	Classic Drama.....	3	Soph., jr., sr.	62 or 63

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

<sup>1</sup> All quarters must be completed before credit is granted.

<sup>2</sup> Adjustments permitted, for the year 1919-20 only, on account of the changes in the curriculum. Students with credit for Course 7-8-9 (old numbering), Prose and Poetry, may register for Course 62, 63, 64. Students with credit for Course 24-25-26 (old numbering), Elementary Composition, may register for Course 50-51-52. Students with credit for Course 27-28-29 (old numbering), Elementary Conversation, may register for Course 53-54-55.

#### INTRODUCTORY COURSES

- 1f,s. BEGINNING. Pronunciation, conversation, grammar and composition; selected readings in easy prose and verse. ....
- 2f,w. BEGINNING, INTERMEDIATE. Continuation of Course I. ....
- 3f,s. BEGINNING, ADVANCED. Selected texts from modern writers. ....
- 10f,s. RAPID READING. Modern narrative prose. KROESCH.
- 11w,s. ADVANCED RAPID READING. Continuation of Course 10. Selected dramas from the eighteenth and nineteenth centuries. KROESCH.
- 12f,s. NARRATIVE PROSE. Reading texts selected from modern prose writers. Grammar review and composition. ....
- 13f,w. ADVANCED NARRATIVE PROSE. Continuation of Course 13. ....
- 14w,s. PROSE AND POETRY. Narrative readings and selected poetry; composition. ....
- 28f,w-29w,s. ADVANCED CHEMICAL GERMAN. Selections from more difficult works on chemistry. DAVIES.
- 31f,w-32w,s. MEDICAL GERMAN. Readings from general works on physiology, anatomy, and bacteriology. BURKHARD.

50f-51w-52s. COMPOSITION. Aims to develop grammatical correctness. Translations from English selections. Essay writing on assigned subjects. MYERS.

53f-54w-55s. CONVERSATION. Aims to develop ease and correctness of oral expression. Organized on the laboratory plan—one hour credit with two hours of recitation and one hour of outside reading. MYERS.

62f,s. GERMAN COMEDIES. Reading of the best comedies of the eighteenth and nineteenth centuries. DAVIES, MYERS.

63w. MODERN DRAMA. Plays of modern dramatists; Hauptmann, Sudermann, Fulda, and others. DAVIES, MYERS.

64s. CLASSIC DRAMA. Plays of Lessing, Goethe, and Schiller. DAVIES, MYERS.

### HOME ECONOMICS

Professor MILDRED WEIGLEY.

#### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Course</i>				
24s.	Camp Cookery.....	3	All	None

For additional courses see the bulletin of the Courses in Home Economics.

#### INTRODUCTORY COURSE

24s. CAMP COOKERY. Designed to give prospective foresters, engineers, and others a knowledge of the simpler cookery processes, and of such adaptations as are practicable in the several types of out-of-doors camps. Given in alternate years. (Offered in 1919-20.) .....

### HORTICULTURE

Associate Professors WILFRID G. BRIERLEY, LEROY CADY, MAXWELL J. DORSEY; Extension Specialist ROGER S. MACKINTOSH.

*General statement.*—For specialization in this department, see special requirements in Course of Study.

#### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
6s.	Principles of Fruit Growing...	3	Soph., jr., sr.	Bot. 10 cred.
13f.	Fruit Handling.....	3	Jr., sr.	6
21w.	Small Fruit Culture.....	3	Soph., jr., sr.	Bot. 10 cred.
32s.	Vegetable Gardening.....	3	Soph., jr., sr.	Bot. 10 cred.
33w.	Vegetable Forcing.....	3	Jr., sr.	32
50s.	Floriculture.....	3	All	None
54w.	Greenhouse Construction and Management.....	2	All	None

No.	Title	Credits	Offered to	Prereq. courses
56w,s.	Plant Propagation.....	2	All	None
71f,s.	Landscape Gardening.....	3	All	None
73f.	Nursery Practice.....	2	All	None
90f.	General Horticulture.....	3	All	None
94w-95s.	Home and School Gardening..	6	Jr., sr. <sup>1</sup>	None
<i>Advanced Courses</i>				
107f.	Orchard Management.....	3	Jr., sr.	6 or 90
109f.	Principles of Genetics.....	3	Jr., sr.	Bot. 10 cred. An. Biol. 10 cred.
110w.	Fruit Breeding.....	3	Jr., sr.	109
111f.	Fruit Variety Studies.....	3	Jr., sr.	6 or 90
131f.	Advanced Market Gardening..	3	Sr.	32
151f.	Advanced Floriculture.....	3	Sr.	50, 56
191w-192s.	Special Problems.....	6	Sr.	107 or 131
193f-194w-195s.	Hort. Seminar.....	3	Sr.	9 cred. excl. of 90 and 94

<sup>1</sup> Open only to those intending to teach.

#### INTRODUCTORY COURSE

- 6s. PRINCIPLES OF FRUIT GROWING. The fundamental principles of fruit-growing. Sites, soils, nursery stock, planting and planting plans, tillage, fertilization, cover crops, pollination, frost avoidance, pruning, and thinning. Lectures, recitations, references, and laboratory work. BRIERLEY.
- 13f. FRUIT HANDLING. Lectures on early development, packages, harvesting, packing, by-products, coöperation, marketing, and storage. Laboratory and reference work. BRIERLEY.
- 21w. SMALL FRUIT CULTURE. Lectures, references, and problems. Botanical relationship, important species, origin, commercial development, importance, climatic range, sites, soils, propagation, planting plans, planting, pruning, cultivation, irrigation, cover-crops and mulching, inter-cropping and varieties. BRIERLEY.
- 32s. VEGETABLE GARDENING. The principles of vegetable growing for home and market, including all important vegetable crops from seed to harvest. Lectures, recitations, references, laboratory work, and excursions. ....
- 33w. VEGETABLE FORCING. The growing and handling of the vegetable forcing crops; types and management of houses. Lectures, reference reading, field trips, and laboratory. ....
- 50s. FLORICULTURE. Designed to give the student a working knowledge of the culture and uses of common house plants, annuals, perennials, and greenhouse plants. Lectures, reference reading, and laboratory. CADY.
- 54w. GREENHOUSE CONSTRUCTION AND MANAGEMENT. The evolution of the greenhouse, types of houses, materials, and methods of construction. Lectures, field trips, and laboratory work. CADY.

- 56w,s. PLANT PROPAGATION. Methods of propagation of plants by seed, cuttings, layers, grafting, and budding. The principles of greenhouse management, transplanting, watering, and ventilation. Lectures, reference reading, field and laboratory work. CADY.
- 71f,s. LANDSCAPE GARDENING. The practice and principles of landscape gardening as applied to the home and community. Lectures and field trips to parks and private grounds. CADY.
- 73f. NURSERY PRACTICE. Lectures and practice work in management of nursery stock, seeds, bulbs, and plants, particular attention being given to ornamental stock propagation, planting, and storage. CADY.
- 90f,s.<sup>1</sup> GENERAL HORTICULTURE. Lectures and laboratory. A study of the elementary principles of fruit growing, and vegetable gardening as related to home production, and the planting and care of home grounds. BRIERLEY.
- 94w-95s. HOME AND SCHOOL GARDENING. Lectures and laboratory. The elements of horticulture as applied to high-school instruction, plant propagation, fruit growing, home gardening, school gardening, and the planning of home and school grounds. Same as Agr. Educ. 68-69. BRIERLEY, CADY, FIELD.

## ADVANCED COURSES

- 107f. ORCHARD MANAGEMENT. Lectures, references, laboratory, and special problems. The principal problems connected with the management of orchard and small fruit tracts. BRIERLEY.
- 109f. PRINCIPLES OF GENETICS. Lectures and laboratory work designed to familiarize the student with the underlying principles of breeding. Heredity, variation, biometry, and evolution are emphasized. Same as Agron. 103. DORSEY, HAYES.
- 110w. FRUIT BREEDING. Applied genetics is emphasized. The method of breeding each of the important horticultural crops with special attention to experiment station investigations and to the methods used by plant breeders. DORSEY.
- 111f. FRUIT VARIETY STUDIES. The classification and regional distribution of fruits; technical description, identification, and general study of the more important varieties; judging of fruits; fruit literature. Lectures, laboratory work, references. ....
- 131f. ADVANCED MARKET GARDENING. Lectures, references, and special problems. A study in detail of the various vegetables.

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<sup>1</sup> Students specializing in Horticulture may substitute for Hort. 90 any course in Horticulture for which they are eligible. Students majoring in other divisions who desire to take more specialized work in Horticulture may substitute Hort. 6, 21, 32, 50, or 71, provided that a second course from the same group be elected later. Students majoring in Agricultural Education will take Hort. 94 in the junior year.

- 151f. **ADVANCED FLORICULTURE.** Lectures, assigned readings, laboratory, and special problems dealing with the culture, botany, and history of florists' plants and methods of greenhouse management. CADY.
- 191w-192s. **SPECIAL PROBLEMS.** A study of problems based upon the work given in Courses 107 to 131. BRIERLEY.
- 193f-194w-195s. **HORTICULTURAL SEMINAR.** Reports and discussions of problems and investigational work. HORTICULTURE STAFF.

## MILITARY SCIENCE AND TACTICS

Professor FRANK H. BURTON, Colonel, U.S.A.; Assistant Professors JERE BAXTER, Major, U.S.A., ARTHUR E. CLARK, ALLEN T. NEWMAN, Captains U.S.A., HENRY C. BERTELSEN, ERNEST A. NUOFFER, Lieutenants, U.S.A.; Instructors JOHN J. BOWENS, FRANK CRAIN, ELDEN R. FOSSEY, JOSEPH HAVLICEK, HERBERT KETTLE, WILLIAM G. PALMS, Sergeants.

### REQUIRED WORK

All physically fit male students are required to take military training during their first two years in school. This course is a prerequisite for graduation from the University.

All students, registered for military training, of any class are members of the Reserve Officers' Training Corps, and as such are issued all necessary uniform clothing and equipment by the government free of charge.

After completing the two years required, students may discontinue military work if they wish.

### ELECTIVE WORK

Students who have completed the two years of required military work, and are selected for advanced work by the Professor of Military Science and Tactics, and who sign an agreement with the Government, to continue the work for their remaining course in college but not to exceed two years, are eligible for the advanced course in military training, which is prescribed in General Order 49, W.D. 1916, and requires five hours per week—three practical and two theoretical. Three credits for each quarter are allowed for this work.

All advanced course students should take a course in International Law, Military Law, and Military History. These courses are given by the Departments of Political Science and History and are arranged especially for the Military Department.

All members of the advanced course receive their uniforms, equipment, and commutation for subsistence at the rate of forty cents per day during the school year.

All students who complete the advanced course in the Military Department and who graduate from the University, will, if recommended by the Professor of Military Science and Tactics and the President of



the University, be commissioned by the President of the United States, in the Officers' Reserve Corps.

## MUSIC

### COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professor CARLYLE M. SCOTT; Assistant Professor DONALD N. FERGUSON;  
Instructors ABE PEPINSKY, GERTRUDE REEVES.

*General statement.*—Credit is offered to seniors and juniors in the College of Agriculture, Forestry, and Home Economics, who may wish to elect work in the Department of Music. Nine credits may be obtained.

#### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
14f-15w-16s.	History of Music.....	9 <sup>2</sup>	Soph., jr., sr.	None
17f-18w-19s.	Appreciation of Music.....	3 <sup>2</sup>	Jr., sr.	None
51f-52w-53s. <sup>1</sup>	Violin.....	6-12 <sup>2</sup>	Jr., sr.	None
91f-92w-93s. <sup>1</sup>	Orchestra.....	3 <sup>2</sup>	Jr., sr.	See statement

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

<sup>1</sup> Given at the University Farm.

<sup>2</sup> The full course must be completed before credit will be allowed.

#### INTRODUCTORY COURSES

14f-15w-16s. HISTORY OF MUSIC. Some account of primitive systems and of the early Christian modal and harmonic development, leading to a general survey of musical literature from Bach to the present time. FERGUSON.

17f-18w-19s. APPRECIATION OF MUSIC. A non-technical course. REEVES.

51f-52w-53s. VIOLIN. Candidate must be able to play the first ten of Kreutzer's forty etudes, and the easier Handel and Mozart sonatas. PEPINSKY.

91f-92w-93s. ORCHESTRA. FERGUSON, PEPINSKY.

## PHYSICAL EDUCATION

### FOR MEN

Director LOUIS J. COOKE; Assistant Director WILLIAM K. FOSTER; Instructors EDWIN S. BROWN, PERCY C. GLIDDEN, D. C. MITCHELL; Assistants KARL P. BUSWELL, HARRY GOLDIE.

*General statement.*—The purpose of the Department is to provide all men of the University opportunity for exercise in order to maintain and build up their general health. It also provides special training for the correction of physical defects and functional derangements,

A physical examination is required of all new matriculants, and of all others using the department privileges, at the beginning of the year, and as often during their college course as their physical condition may indicate. Students taking the required work in physical education are examined at the close of the year. A study of these records shows a marked improvement in the standard of health of the average student during his college course.

The gymnasium, swimming pool, and baths are open to all students of the University, who are free to use the apparatus and to pursue a course in physical training under the supervision of the Director and his assistants.

Those students, taking the required course in physical education, who can not swim must make a reasonable effort, as determined by the Department, to pass the swimming and life-saving requirements, and will be assigned special hours for instruction.

COURSES				
No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f.	Personal Hygiene.....	1	Fr.	None
2f-3w <sup>1</sup> -4s.	Gymnasium and Swimming...	None	Fr.	None
5f-6w-7s.	Advanced Leaders.....	3 <sup>2</sup>	Soph., jr., sr.	Instructor's permission
8f-9w-10s.	Corrective Gymnastics.....	None	All	None
11w-12s.	Wrestling.....	None	All	Instructor's permission
13f-14w-15s.	Intermediate Swimming.....	None	All	Instructor's permission
16f-17w-18s.	Advanced Swimming.....	None	All	Instructor's permission
19w-20s.	Boxing.....	None	Fr.	None
21f-22w-23s.	Intramural Athletics.....	None	All	None

<sup>1</sup> Given at the University Farm.

<sup>2</sup> Full course must be completed before credit is allowed.

#### COURSES

- 1f. PERSONAL HYGIENE. Two hours per week; first six weeks of fall quarter. Examinations at close of course. Four hours per week collateral work with themes. COOKE.
- 2f-3w-4s. GYMNASIUM AND SWIMMING. Two hours a week for the winter quarter. Required qualifications in swimming, life-saving, bar-vaulting, jumping, sprinting, running, and on heavy apparatus. MITCHELL.
- 5f-6w-7s. ADVANCED LEADERS. Three hours a week. FOSTER.
- 8f-9w-10s. CORRECTIVE GYMNASTICS. Three hours a week. Special individual courses for students physically defective. BROWN.
- 11w-12s. WRESTLING. Three times per week. Students admitted by special assignment.
- 13f-14w-15s. INTERMEDIATE SWIMMING. Life-saving, efficiency swimming, and fancy diving. Instruction is given in rescuing and restoring the apparently drowned and other useful swimming accomplishments. GLIDDEN, BUSWELL.

16f-17w-18s. **ADVANCED SWIMMING.** Life-saving, efficiency swimming, and fancy diving. Instruction is given in rescuing and restoring the apparently drowned and other useful swimming accomplishments. GLIDDEN, BUSWELL.

19w-20s. **BOXING.** By special arrangement a few students may be accommodated in this class which meets twice per week. GOLDIE.

21f-22w-23s. **INTRAMURAL ATHLETICS.** Competitive games in the various athletic leagues in football, basket-ball, hockey, track, and field events, baseball, tennis, swimming, handball, bowling, etc. FOSTER.

## PHYSICS

### COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors HENRY A. ERIKSON, ANTHONY ZELENY; Associate Professor JOHN T. TATE; Professorial Lecturer LOUALLEN F. MILLER.

#### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
21f,w,s,su.	Elements of Mechanics.....	4	All	Trigonometry
22f,w,s,su.	Elements of Mechanics Laboratory.	1	All	21 or parallel
31f.	Acoustics.....	3	All	None
41w.	Sound and Heat.....	4	All	21
42w.	Sound and Heat Laboratory.....	1	All	22, 41 or parallel
51f.	Light.....	4	All	21
52f.	Light Laboratory.....	1	All	22, 51 or parallel
61s.	Magnetism and Electricity.....	4	All	21
62s.	Magnetism and Electricity Laboratory.....	1	All	22, 61 or parallel

For additional courses see bulletin of the College of Science, Literature, and the Arts.

#### INTRODUCTORY COURSES

21f,w,s,su. **ELEMENTS OF MECHANICS.** Mechanics of solids, fluids, and wave motion. A study of the simpler fundamental principles. First part of a general Course 21, 41, 51, 61. Course 22 should be taken in conjunction with this course. ZELENY, MILLER, TATE.

22f,w,s,su. **ELEMENTS OF MECHANICS LABORATORY.** Measurements in the mechanics of solids, fluids, and wave motion; the laboratory part supplementing Course 21. MILLER.

31f. **ACOUSTICS.** A study of the fundamental principles of sound. A course designed primarily for the students in the Department of Music. Open also to other students. ERIKSON.

41w. **SOUND AND HEAT.** A study of the principles underlying sound and heat phenomena. Course 42 should be taken in conjunction with this course. ZELENY, MILLER.

- 42w. SOUND AND HEAT LABORATORY. The laboratory part supplementing Course 41. MILLER.
- 51f. LIGHT. A study of the principles underlying light phenomena. Course 52 should be taken in conjunction with this course. ZELENY, MILLER.
- 52f. LIGHT LABORATORY. The laboratory part supplementing Course 51. MILLER.
- 61s. MAGNETISM AND ELECTRICITY. A study of the principles underlying magnetic and electric phenomena. Course 62 should be taken in conjunction with this course. ZELENY, MILLER.
- 62s. MAGNETISM AND ELECTRICITY. The laboratory part supplementing Course 61. ZELENY.

## PLANT PATHOLOGY AND BOTANY

### COLLEGE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS

Professors EDWARD M. FREEMAN, ELVIN C. STAKMAN; Assistant Professor GUY R. BISBY; Instructors ROBERT C. DAHLBERG, ALVIN H. LARSON, ALLEN G. NEWHALL; Extension Specialist ARNE G. TOLAAS.

*General statement.*—For specialization in this department, see special requirements in Course of Study.

### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f-su.	Plant Pathology.....	5	Jr., sr.	Bot. 10 cred.
6s.	Plant Pest Control.....	3	Jr., sr.	1, Ent. 3.
7w-8s.	Weeds and Grasses.....	6	Soph., jr., sr.	Bot. 10 cred.
9f-su.	Weeds and Seed Testing.....	3	Soph., jr., sr.	Bot. 10 cred.
10s.	Forest Pathology.....	5	Soph., jr., sr.	Bot. 10 cred.
12w.	Seed Problems.....	3	Jr., sr.	9
14s.	Plant Disease Control.....	5	Jr., sr.	1, Ent. 1 or 3
<i>Advanced Courses</i>				
105f-106w-107s.	Mycology.....	9	Jr., sr.	Bot. 7,11 or equiv.
108f-109w.	Methods.....	6	Jr., sr.	1, Bact. 6
110s.	Principles of Pathology.....	3	Jr., sr.	1, Bact. 6
111w-su.	Diseases of Field Crops.....	3	Jr., sr.	1
112s,su.	Diseases of Fruit and Vegetable Crops.....	3	Jr., sr.	1

### INTRODUCTORY COURSES

- 1f,su. PLANT PATHOLOGY. Elementary study of plant diseases due to fungi, bacteria, and slime molds; life histories and preventive methods. Lectures, laboratory, and reference. Not open to those who have completed 10. FREEMAN, STAKMAN, BISBY.
- 6s. PLANT PEST CONTROL. The theory and practice of control of insect and fungous pests of crop plants. Practical applications. Same as

- Ent. 16. Not open to those who have completed 14. STAKMAN, BISBY, NEWHALL.
- 7w-8s. WEEDS AND GRASSES. Agricultural and applied botanical study of weeds and grasses with special reference to agricultural importance. DAHLBERG.
- 9f,su. WEEDS AND SEED TESTING. Detailed study of seed-testing methods and seed legislation. Weed and crop seeds and weed plants studied with special reference to identification. DAHLBERG, LARSON.
- 10s. FOREST PATHOLOGY. Elementary study of plant diseases due to fungi, bacteria, and slime molds; life histories and preventive methods. Lectures, laboratory, and reference. Not open to those who have completed 1. (Offered in alternate years. Not given in 1919-20.) FREEMAN, STAKMAN.
- 12w. SEED PROBLEMS. Special seed problems are assigned. Advanced work in seed-testing methods. DAHLBERG.
- 14s. PLANT DISEASE CONTROL. A detailed study of methods of controlling diseases of plants of parasitic origin. Spray materials and spray machinery. Practical applications. Not open to those who have completed 6. Given in alternate years. (Not offered in 1919-20.) BISBY, NEWHALL.

## ADVANCED COURSES

- 105f-106w-107s. MYCOLOGY. A general study of the taxonomy and biology of fungi. Lectures, laboratory, greenhouse, and field work. FREEMAN, STAKMAN, BISBY.
- 108f-109w. METHODS. Plant pathological methods including mycological and bacteriological technique, laboratory, field, and inoculation investigational technique. Laboratory and lecture. Special problems. STAKMAN, BISBY.
- 110s. PRINCIPLES OF PATHOLOGY. Comparative biology of plant pathogens; pathological plant anatomy; parasitism, biologic specialization, resistance, and immunity. Will be given in close coöperation with Agricultural Biochemistry Division and divisions offering work in plant breeding. STAKMAN.
- 111w,su. DISEASES OF FIELD CROPS. Special detailed study of diseases of cereal and forage crops, including symptomology, etiology, and practical methods of control. Laboratory, lecture, and field work. STAKMAN.
- 112s,su. DISEASES OF FRUIT AND VEGETABLE CROPS. Special study of diseases of fruit and vegetable crops, especially of Minnesota crops including diseases of crops raised under glass. Laboratory, lecture, and greenhouse work. BISBY, NEWHALL.



## POLITICAL SCIENCE

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors JEREMIAH S. YOUNG, CEPHAS D. ALLIN; Associate Professor  
RAYMOND MOLEY; Instructor ALBERT J. LOBB.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f. <sup>1</sup>	American Government.....	5	Soph., jr., sr.	None
7f,w.	State and Local Government.....	5	Soph., jr., sr.	1
28s. <sup>1</sup>	Business Law.....	5	Jr., sr.	10 cred. in Pol. Sci. or Econ.
41s.	Rural Government.....	3	All	1

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

<sup>1</sup> Given at University Farm.

## INTRODUCTORY COURSES

- 1f. AMERICAN GOVERNMENT. Organization and actual workings of the national government; nature and origin of the American governmental system. ALLIN.
- 7f,w. STATE AND LOCAL GOVERNMENT. Comparison of American state governments, especially Minnesota; relation of states to the United States and to local units of government; recent experiments such as initiative and referendum, the recall and primaries; social and economic legislation. MOLEY, LOBB.
- 28s. BUSINESS LAW. A course in Business Law (arranged for students in the College of Agriculture, Forestry, and Home Economics), including contracts, agency, mortgages, conveyances, and negotiable instruments. LOBB.
- 41s. RURAL GOVERNMENT. The organization and functions of towns, school districts, villages, and counties; the assessment and taxation of property; road laws; and drainage. LOBB.

## POULTRY HUSBANDRY

## ANIMAL INDUSTRY GROUP

Professor ARTHUR C. SMITH; Extension Specialist NORTON E. CHAPMAN.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f,w,s.	Poultry.....	3	All	None
2w.	Poultry Judging.....	3	All	1
4s.	Incubating and Brooding.....	3	All	None

## INTRODUCTORY COURSES

- 1f,w,s. POULTRY. The poultry industry; best methods of care and management of fowls, turkeys, ducks, and geese, and the most important breeds of same. SMITH.
- 2w. POULTRY JUDGING. The history, standard-requirements, and common defects of the leading commercial, standard breeds and varieties and determination and standard values by the score-card and comparison methods. SMITH.
- 4s. INCUBATING AND BROODING. Instruction and practice in incubation and brooding, selection of breeding stock and eggs for hatching, and feeding young chicks. Of practical value to teachers of agriculture and poultry raisers. SMITH.

## PSYCHOLOGY

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Associate Professors RICHARD M. ELLIOTT, WILLIAM S. FOSTER, HERBERT WOODROW; Assistant Professors MABEL R. FERNALD, KARL S. LASHLEY, JOHN J. B. MORGAN; Instructor FRANCES E. LOWELL.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f-2w-3s.	General Psychology.....	9	Soph., jr., sr.	None
<i>Advanced Courses</i>				
101f-102w.	Experimental Psychology.....	6	Jr., sr.	1-2-3
103s.	Quantitative Psychology.....	3	Jr., sr.	1-2-3
108w-109s.	Advanced General Psychology...	6	Jr., sr.	1-2-3
114w-115s.	Human Behavior.....	6	Jr., sr.	1-2-3
119f-120w	Animal Behavior.....	6	Jr., sr.	1-2-3
121s.	Neuro-Psychology.....	3	Jr., sr.	1-2-3
125f-126w.	Differential Psychology.....	6	Jr., sr.	1-2-3
127s.	Social Psychology.....	3	Jr., sr.	1-2-3
131f-132w-133s.	Child Mind.....	9	Jr., sr.	1-2-3
137f-138w.	Applied Psychology.....	6	Jr., sr.	1-2-3
144w-145s.	Abnormal Psychology.....	6	Jr., sr.	1-2-3

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

## INTRODUCTORY COURSES

- 1f-2w-3s. GENERAL PSYCHOLOGY. An introductory survey of psychology; its material, fundamental laws, applications, and relations to other sciences. Laboratory experiments provide illustrative material and training in methods. All instructors.

## ADVANCED COURSES

- 101f-102w. EXPERIMENTAL PSYCHOLOGY. A laboratory course of standard experiments in the analysis and measurement of mental phenomena. WOODROW.

- 103s. QUANTITATIVE PSYCHOLOGY. Psychophysics and the theory of mental measurement. WOODROW.
- 108w-109s. ADVANCED GENERAL PSYCHOLOGY. A systematic presentation of the laws of mental activity. FOSTER.
- 114w-115s. HUMAN BEHAVIOR. An analysis from the point of view of the objective school of psychologists. ELLIOTT.
- 119f-120w. ANIMAL BEHAVIOR. The development of reaction-system in animals, with emphasis upon the application of studies of animals to the solution of general problems in physiological psychology. LASHLEY.
- 121s. NEURO-PSYCHOLOGY. Specialization of function in the nervous system in relation to behavior. Discussion from the standpoint of psychology of current theories of integration and localization. LASHLEY.
- 125f-126w. DIFFERENTIAL PSYCHOLOGY. Important distinguishing characteristics (psychological) of individuals and of groups. Emphasis on experimental and statistical methods of discovering differences and of making comparisons. Each student participates in investigation of definite problems and in analysis of results. FERNALD.
- 127s. SOCIAL PSYCHOLOGY. A study of the dependence of familiar forms of social organization and behavior upon the fundamental laws of mental activity. The adjustment of the innate mental equipment of the individual to the forms of social groups. FERNALD.
- 131f-132w-133s. CHILD MIND. General intelligence and special mental abilities; their development and their relation to heredity, physiological factors, education, speech defects, and delinquency. LOWELL.
- 137f-138w. APPLIED PSYCHOLOGY. A survey of the application of psychology, with especial reference to business. MORGAN.
- 144w-145s. ABNORMAL PSYCHOLOGY. A systematic review of psychopathology in relation to normal behavior. MORGAN.

### RURAL PUBLICATIONS AND JOURNALISM

Professor WILLIAM P. KIRKWOOD; Assistant Professor NORMAN J. RADDER.

*General statement.*—The aim of this Division is to give practical training in rural and in agricultural journalism. The work in rural journalism includes the editing and managing of the country newspaper. The work in agricultural journalism covers writing for the rural press, for the agricultural press, bulletin writing, and agricultural publicity.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
7f.	Editorial Administration.....	5	Sr.	16-17
8w.	Business Administration.....	5	Sr.	16-17
10f-11w-12s.	Agricultural Journalism.....	9	Jr., sr.	Rhet. 19 cred. or Rhet. 9 cred., Eng. 9 cred. <sup>1</sup>
13f,w,s-14w, s,f-15s,f,w.	Reporting.....	9	Soph., jr., sr.	Rhet. 9 cred.
16f-17w.	Copy Reading.....	6	Jr., Sr.	13-14-15
18s.	News Editing.....	3	Jr., sr.	16-17
19s.	Bulletin Writing and Agricul- tural Publicity.....	3	Sr.	10-11-12

<sup>1</sup> Rur. and Agr. Jour. 13-14-15 also advised.

## INTRODUCTORY COURSES

- 7f. EDITORIAL ADMINISTRATION. The editor in his capacity as editor; formulation of policy; organization of news-gathering staff; presentation of the news to the public. KIRKWOOD.
- 8w. BUSINESS ADMINISTRATION. The business problems of the rural weekly including general accounting, job cost finding, circulation building, and advertising problems. ....
- 10f-11w-12s. AGRICULTURAL JOURNALISM. Gathering and writing agricultural news and the writing of articles for the agricultural press and other class papers. Lectures and practical work on Agricultural College publications. KIRKWOOD.
- 13f,w,s-14w,s,f-15s,f,w. REPORTING. Organization, methods, and material in newspaper production; forms of newspaper stories; methods of gathering and writing news; laboratory practice by assignments on University publications. RADDER.
- 16f-17w. COPY READING. Study and practice in editing copy for the newspaper and in writing headlines. Laboratory practice. RADDER.
- 18s. NEWS EDITING. Continuation of 16 with special attention to type, make up, and printing. Laboratory practice on University publications. RADDER.
- 19s. BULLETIN WRITING AND AGRICULTURAL PUBLICITY. Application of the rules of writing for the press to preparation of popular and technical bulletins. Mediums and methods through which information may be brought to attention of communities and people of the open country. KIRKWOOD.

## RHETORIC

Assistant Professor ROBERT C. LANSING; Instructors ESTELLE COOK,  
GEORGE G. GLICK, RUTH MOHL.

*General statement.*—Rhetoric credits will not be granted officially until the close of the second quarter of the senior year.

Any instructor who finds that a student is deficient in English will submit the name of the student together with the evidence to the chairman of the Students' Work Committee. If the evidence warrants, the Committee will send the student to the Section of Rhetoric for such additional work in English as is needed. This work the student must take, without credit, to validate his freshman and sophomore rhetoric credits.

Students whose work in the rhetoric courses shows at any time an inadequate knowledge of the conventions of English will be required to drop the course and enter a class in elementary rhetoric. These students will be required to complete twenty-two credit hours in rhetoric.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f,w,s.	Rhetoric I.....	3	All	None
2f,w,s.	Rhetoric II.....	3	All	1
3f,w,s.	Rhetoric III.....	3	All	2
4f,w,s.	Elementary Rhetoric.....	3	All	None
11f,w,s.	Argumentation.....	5	Soph., jr., sr.	3
22f,w,s.	Public Speaking.....	5	Soph., jr., sr.	3
24f,w,s.	Advanced Public Speaking.....	3	Soph., jr., sr.	22
25f,w,s.	Fundamentals of Effective Speaking.....	3	Soph., jr., sr.	3

## INTRODUCTORY COURSES

- 1f,w,s. RHETORIC I. Note-taking, gathering and organizing material, oral and written exposition, paragraph structure, supplementary reading. LANSING, MOHL.
- 2f,w,s. RHETORIC II. Sentence structure, exposition and argumentation, supplementary reading. LANSING, MOHL.
- 3w,s. RHETORIC III. Description, narration, diction, supplementary reading. LANSING, MOHL.
- 4f,w,s. ELEMENTARY RHETORIC. Elementary grammatical and rhetorical principles. MOHL.
- 11f,w,s. ARGUMENTATION. Gathering evidence, reasoning, briefing, formal and informal argument, persuasion, debating. LANSING, GLICK, MOHL.
- 22f,w,s. PUBLIC SPEAKING. A practical course in fundamentals of speech-making. Rules of order and practice in conducting assemblies included. GLICK.
- 24f,w,s. ADVANCED PUBLIC SPEAKING. A course in preparing and delivering occasional addresses and informal lectures. GLICK.
- 25f,w,s. FUNDAMENTALS OF EFFECTIVE SPEAKING. The fundamental principles of voice production, articulation, gesture, platform deportment, and expression. COOK.



## ROMANCE LANGUAGES

## COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professor EVERETT W. OLMSTED; Associate Professors RALPH E. HOUSE, EDWARD H. SIRICH; Assistant Professors FRANCIS B. BARTON, JULES F. FRELIN, RUTH S. PHELPS; Professorial Lecturer PEDRO HENRIQUEZ URENA; Instructors HERBERT E. CLEFTON, SOLOMON M. DELSON, MARGUERITE GUINOTTE, SAMUEL VASCONCELOS.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
4f,w,s-5w,s,f.	Beginning French . . . . .	10 <sup>1</sup>	All	None
7f,w,s-8w,s,f.	Intermediate French . . . . .	10 <sup>1</sup>	All	4-5 or 2 yrs. H.S.
13f-14w-15s.	Survey of French Literature . . . .	9 <sup>1</sup>	All	7-8 or 3 yrs. H.S.
16f-17w-18s.	Elementary French Conversation	3 <sup>1</sup>	All	7-8 or 3 yrs. H.S.
19f-20w-21s.	Elementary French Composition.	3 <sup>1</sup>	All	7-8 or 3 yrs. H.S.
31f,w,s-32w, s,f.	Beginning Spanish . . . . .	10 <sup>1</sup>	All	None
34f,w,s-35w, s,f.	Intermediate Spanish . . . . .	10 <sup>1</sup>	All	31-32 or 2 yrs. H.S.
37f-38w-39s.	Survey of Spanish Literature . . .	9 <sup>1</sup>	All	34-35 or 3 yrs. H.S.
40f-41w-42s.	Elementary Spanish Conversa- tion . . . . .	3 <sup>1</sup>	All	34-35 or 3 yrs. H.S.
43f-44w-45s.	Elementary Spanish Composition	3 <sup>1</sup>	All	34-35 or 3 yrs. H.S.

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

<sup>1</sup> The full course must be completed before credit will be allowed.

## INTRODUCTORY COURSES

- 4f,w,s-5w,s,f. BEGINNING FRENCH. Pronunciation, grammar, oral exercises, translation. FRELIN, DELSON, GUINOTTE.
- 7f,w,s-8w,s,f. INTERMEDIATE FRENCH. Review of grammar, connected prose composition, conversation, and reading of representative authors. FRELIN, CLEFTON, GUINOTTE.
- 13f-14w-15s. SURVEY OF FRENCH LITERATURE. This course will outline the history of French literature from 1600 to present day, and is prerequisite for the courses devoted to special periods. Representative texts will be read. SIRICH, PHELPS, CLEFTON.
- 16f-17w-18s. ELEMENTARY FRENCH CONVERSATION. A small amount of outside preparation will be required. BARTON, FRELIN, GUINOTTE.
- 19f-20w-21s. ELEMENTARY FRENCH COMPOSITION. BARTON, FRELIN, GUINOTTE.
- 31f,w,s-32w,s,f. BEGINNING SPANISH. Pronunciation, grammar, oral exercises and translation. OLMSTED, HENRIQUEZ, VASCONCELOS.
- 34f,w,s-35w,s,f. INTERMEDIATE SPANISH. Review of grammar, conversation, connected prose composition, and reading of representative authors. HOUSE, VASCONCELOS.

37f-38w-39s. SURVEY OF SPANISH LITERATURE. An outline of the history of Spanish literature from 1500 to the present day, based upon texts and collateral reading. Prerequisite for courses devoted to special periods. HOUSE.

40f-41w-42s. ELEMENTARY SPANISH CONVERSATION. A small amount of outside preparation will be required. VASCONCELOS.

43f-44w-45s. ELEMENTARY SPANISH COMPOSITION. VASCONCELOS.

## SOCIOLOGY AND SOCIAL WORK

Professors ARTHUR J. TODD, ALBERT ERNEST JENKS; Associate Professors LUTHER L. BERNARD, MANUEL C. ELMER; Assistant Professors ROSS L. FINNEY, GUSTAF A. LUNDQUIST.

### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
1f,w,s.	Introduction to Sociology.....	3 or 5 <sup>2</sup>	Soph., jr., sr.	None
6w.	Modern Social Reform Movements.....	3	Soph., jr., sr.	1
14f,w.	Rural Sociology.....	3	Jr., sr.	1 <sup>1</sup>
<i>Advanced Courses</i>				
114s.	Rural Social Institutions.....	3	Jr., sr.	14

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

<sup>1</sup> No prerequisite for seniors in the College of Agriculture, Forestry, and Home Economics.

<sup>2</sup> Offered as a three-credit course at University Farm, fall quarter. Open only to students in Agriculture, Forestry, and Home Economics.

### INTRODUCTORY COURSES

1f,w,s. INTRODUCTION TO SOCIOLOGY. A study of the origin and development of human societies; various agencies which have determined the type of social life; social organization, institutions, and progress; bearing of sociology upon other social sciences and arts. TODD, JENKS, BERNARD, ELMER, FINNEY, LUNDQUIST.

6w. MODERN SOCIAL REFORM MOVEMENTS. A survey of attempts to overcome certain social maladjustments: child labor, the city, bad housing, poverty, degeneracy; movements for public health, industrial democracy, social insurance, protection of infancy and youth, public recreation, etc. TODD, ELMER, FINNEY.

14f,w. RURAL SOCIOLOGY. The background and evolution of country life; rural conveniences, communication, coöperation; rural social institutions, especially the family, school, church and social center; rural leadership, surveys, organization, social agencies. BERNARD, LUNDQUIST.

### ADVANCED COURSES

114s. RURAL SOCIAL INSTITUTIONS. A detailed study of the problems of organization and efficiency of selected rural institutions, especially re-

ligious, educational, civic, and recreational. Lectures, discussion, reports. LUNDQUIST.

## SOILS

Professor FREDERICK J. ALWAY; Assistant Professor CLAYTON O. ROST; Instructor PAUL R. McMILLER; Extension Specialist GEORGE H. NESOM.

*General statement.*—For specialization in this Department see special requirements in Course of Study.

### COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Course</i>				
1s.	Soils.....	5	Jr., sr.	Chem. 10 cred.
<i>Advanced Courses</i>				
101f.	Chemical Analysis of Soils.....	5	Sr.	1, Quant. Anal.
102f,w.s.	Special Problems in Soils.....	†	Sr.	101, 103
103f.	Mechanical Analysis of Soils.....	3	Jr., sr.	1
104s.	Soil Surveying.....	3	Jr., sr.	103
105w.	Minnesota Soils.....	3	Sr.	1

† Credit according to the amount of work.

### INTRODUCTORY COURSE

1s. SOILS. Formation, physical properties, and chemical composition of soils; micro-organisms of the soil; farm manures, green manures, commercial fertilizers, and soil amendments; causes of unproductivity. Lectures, recitations, laboratory, and field work. ALWAY.

### ADVANCED COURSES

101f. CHEMICAL ANALYSIS OF SOILS. A laboratory course on the chemical examination of soils, fertilizers, and soil amendments. ROST.

102f,w.s. SPECIAL PROBLEMS IN SOILS. Individual laboratory or field work upon some special soil problem in soil physics, soil chemistry, or soil management. Arrangement must be made in advance. ALWAY.

103f. MECHANICAL ANALYSIS OF SOILS. A laboratory course on the beaker, and centrifuge methods of mechanical analysis. McMILLER.

104s. SOIL SURVEYING. Field practice in surveying soils and the preparation of soil maps. McMILLER.

105w. MINNESOTA SOILS. Detailed study of the soils of Minnesota. Origin, formation, and classification; physical and chemical characteristics; moisture relations; response to manures, fertilizers, and soil amendments; naturally unproductive types and their reclamation. Lectures, laboratory, and field work. ALWAY.



## VETERINARY MEDICINE

## ANIMAL INDUSTRY GROUP

Professors CLIFFORD P. FITCH, WILLARD L. BOYD, MYRON H. REYNOLDS;  
Assistant Professor HOWARD C. H. KERNKAMP; Instructor WIL-  
LIAM A. BILLINGS; Assistant CLAUDE D. GRINNELLS.

## COURSES

No.	Title	Credits	Offered to	Prereq. courses
<i>Introductory Courses</i>				
2f.	Anatomy of Domestic Animals.....	5	Jr., sr.	None
3w-4s.	Comparative Physiology.....	6	Jr., sr.	2
6f.	Physiology and Hygiene of Breeding.....	3	Sr.	3-4
8s.	Veterinary Studies.....	5	Soph., jr., sr.	None
12w.	Infectious Diseases.....	3	Jr., sr.	3-4, Bact. 6
13s.	Non-infectious Diseases.....	3	Sr.	3-4

## INTRODUCTORY COURSES

- 2f. ANATOMY OF DOMESTIC ANIMALS. Anatomy of the common farm animals with special reference to bones, muscles, and viscera. Lectures and demonstrations. KERNKAMP.
- 3w-4s. COMPARATIVE PHYSIOLOGY. A recitation and lecture course in physiology with special reference to the physiology of domesticated animals. Special emphasis is given to digestion and metabolism. FITCH.
- 6f. PHYSIOLOGY AND HYGIENE OF BREEDING. Anatomy and physiology of reproduction. Embryology, obstetrics, sterility, hygiene, and common diseases of breeding animals. BOYD.
- 8s. VETERINARY STUDIES. Study of diseases; causes, prevention, treatment of common diseases; simple surgical operations; lameness and unsoundness; common medicines. Planned especially for students taking only one quarter veterinary work. Not open to those who have completed 12-13. REYNOLDS.
- 12w. INFECTIOUS DISEASES. Etiology, morbid anatomy, symptomology, diagnosis, prevention, and the basis of treatment of the common infectious diseases of animals. Special instruction will be given in preparation and use of vaccines, bacterins, serums, and anti-toxins. Those who have completed Course 8 can obtain only half credit for this course. FITCH.
- 13s. NON-INFECTIOUS DISEASES. General principles of diagnosis, causes, morbid anatomy, symptomatology, prevention, and the basis of treatment of the non-infectious diseases of animals. Those who have completed Course 8 can obtain only half credit for this course. BOYD.